International Marine Engineering

DECEMBER, 1907.

THE HAMBURG-AMERICAN STEAMER KRONPRINZESSIN CECILIE.

BY F. C. GUENTHER.

The *Kronprinzessin Cecilie* was built by the Friedrich Krupp Aktiengesellschaft Germaniawerft, Kiel, Germany, the contract having been awarded this firm by the Hamburg-American Line in June, 1904. Her keel was laid Jan. 1, 1905; she was launched Oct. 14, 1905; and was practically ready for sea Feb. 20, 1906, on which date she steamed from Kiel to Hamburg, the delivery taking place on Feb. 24. On March 14, she left Hamburg for her maiden trip to Vera Cruz and Tampico, where she arrived in April, having averaged on this voyage a speed of 14.41 knots.

STERN OF THE SHIP, SHOWING ARRANGEMENT OF PROPELLERS AND WEB STRUTS.

The ship has been built to the Germanischer Lloyd's rules for the highest class 100 + A_1 L E, and subjected to the Seeberufsgenossenschaft's, to the Board of Trade's and to the German and American laws, for the carriage of emigrants. She is rigged as a two-masted schooner, with derricks on both masts. Accommodation is provided for 235 first class, 40 second class, and 914 third class passengers, which, with the crew of 200 men, make an aggregate of 1,389 persons on board when all accommodations are taken. The main dimensions are:

	M.	Ft.	Ins.
Length between perpendiculars..	143.25	470	
Extreme beam	16.76	55	
Depth, molded.....	10.04	32	11⅜
Mean draft	7.62	25	

Ratio—Length to beam, 8.545.
Ratio—Length to depth, 14.278.
Tonnage, gross register, 8,688.
Net tonnage, 5,053.
Displacement in tons, 14,350.
Block coefficient of fineness, 0.777.
Deadweight carrying capacity, tons, 7,380.

THE SMOKING ROOM IS LOCATED AT THE AFTER END OF THE PROMENADE DECK.

The first-class accommodation on the upper deck, bridge deck and promenade deck is luxuriously and beautifully decorated. Four apartments, fitted as cabines-de-luxe, on the bridge and promenade decks, include sitting room, bedroom,

A GENERAL VIEW OF THE SOCIAL HALL.

FIRST CABIN DINING SALOON, SEATING ABOUT TWO HUNDRED PASSENGERS.

bath and toilet. The first-class dining room on the bridge deck extends through the full width of the ship, and can accommodate 190 persons. The sides are varnished and elaborately ornamented with carvings. The chairs are mahogany colored, and have ample space. Like all other apartments and cabins, the dining saloon is heated by steam and lighted by electricity.

A CORNER OF THE MUSIC AND WRITING ROOM.

The galley, situated aft of the dining saloon, and all accessory accommodation, such as pantry, baker's and butcher's shops and refrigerating room, are all roomy and their fittings up to date.

The social hall and music room are situated on the promenade deck, above the dining saloon. They are very spacious, tastefully and richly decorated, and well lighted by large square windows. The walls are varnished with cream white, white, varnished ceiling. Above this dining saloon are the second-class smoking room, with walls of smoked oak and a white polished ceiling, and the ladies' drawing room.

Other notable features of the ship are the breadth and size of the promenade deck; a specially well-fitted gymnasium; a very complete plant of telephones connecting most of the staterooms with the first-class pantry; a wireless telegraph outfit; a complete system of ventilation, by means of which the

THE HAMBURG AMERICAN CRUISING STEAMER KRONPRINZESSIN CECILIE.

decorated with gold, and fitted with painted panels representing the home of the German crown princess.

The first-class smoking room, which is aft of the engine hatch, on the same deck as the social hall, is a broad room with walls finished in smoked oak and hand carved. This room is fitted with leather upholstery and very simply decorated, so that the furniture may not retain much of the odors of tobacco. Incandescent lamps are provided, and day-

air in all rooms is continually renewed; a great number of bathrooms, separate for passengers of all classes and the crew; great provision rooms, with a capacity of 11,018 cubic feet; and seven refrigerating rooms, with an aggregate capacity of 9,394 cubic feet.

THE HULL.

The hull construction is entirely of best mild Siemens Martin steel, with a double bottom extending the full length

THE KRONPRINZESSIN CECILIE LEAVING THE WAYS.

light is admitted through large square windows and a skylight opening in the center of the ceiling.

The second-class staterooms are located on the upper deck and poop deck aft, and are finished in a style similar to the first-class accommodation, though less elaborately. The second-class dining saloon, which is on the upper deck aft, has partitions of polished maple with inlaid work, and a

of the ship. The hull is divided by nine watertight bulkheads extending to the upper deck into ten watertight compartments; besides a chain-locker bulkhead, and two coal-bunker transverse bulkheads. There are 210 transverse frames, which stand square to the keel line, and are situated at the following spaces:

Between frames 0 and 189, 27 9/16 inches.

Between frames 189 and 195, 26⅜, 25, 23⅝, 22¼, 20⅞ and 19½ inches.

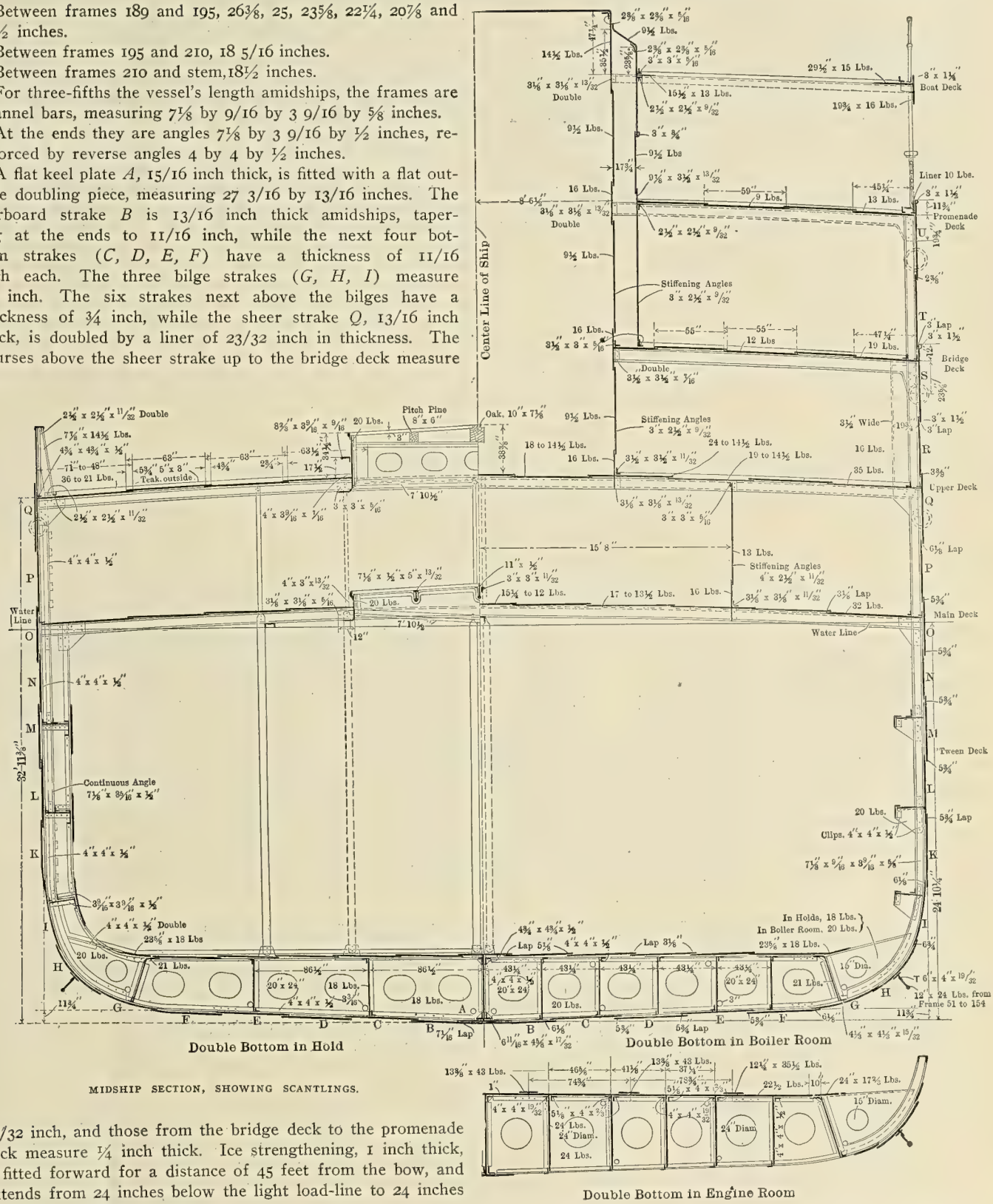
Between frames 195 and 210, 18 5/16 inches.

Between frames 210 and stem, 18½ inches.

For three-fifths the vessel's length amidships, the frames are channel bars, measuring 7⅛ by 9/16 by 3 9/16 by ⅝ inches.

At the ends they are angles 7⅛ by 3 9/16 by ½ inches, reinforced by reverse angles 4 by 4 by ½ inches.

A flat keel plate *A*, 15/16 inch thick, is fitted with a flat outside doubling piece, measuring 27 3/16 by 13/16 inches. The garboard strake *B* is 13/16 inch thick amidships, tapering at the ends to 11/16 inch, while the next four bottom strakes (*C, D, E, F*) have a thickness of 11/16 inch each. The three bilge strakes (*G, H, I*) measure ⅞ inch. The six strakes next above the bilges have a thickness of ¾ inch, while the sheer strake *Q*, 13/16 inch thick, is doubled by a liner of 23/32 inch in thickness. The courses above the sheer strake up to the bridge deck measure



MIDSHIP SECTION, SHOWING SCANTLINGS.

13/32 inch, and those from the bridge deck to the promenade deck measure ¼ inch thick. Ice strengthening, 1 inch thick, is fitted forward for a distance of 45 feet from the bow, and extends from 24 inches below the light load-line to 24 inches above the deep-load waterline.

The center line vertical keelson is 4 feet 7/16 inch deep and ⅝ inch thick. The tank top consists of plates 7/16 inch thick in the cargo hold, with thickness increased to 9/16 inch in boiler room and 1 inch in engine room. Laps are double riveted. Margin plates are ½ inch thick. Three side stringers above the bilge consist of ½-inch plates, each fitted with a continuous angle-bar running along the channel framing and measuring 4 by 4 by ½ inches; a continuous angle-bar turned down over the inboard edge 8⅞ by 3 9/16 by ½ inches, and an intercostal angle 4 by 4 by ½ inches, connecting with side plating. Additional longitudinal stiffness is assured by stringer plates, which on the main deck have a thickness of 13/16 inch, with the next strake of ⅝ inch, and the balance of the steel deck 15/32 inch thick. Stringer plates on the upper deck are ⅞ inch thick, and all other strakes on this deck have a thickness of 15/32 inch. On the bridge deck, which does not much contribute to the longitudinal strength, the stringer is 7/16 inch, the balance of the complete steel deck being 5/16 inch thick.

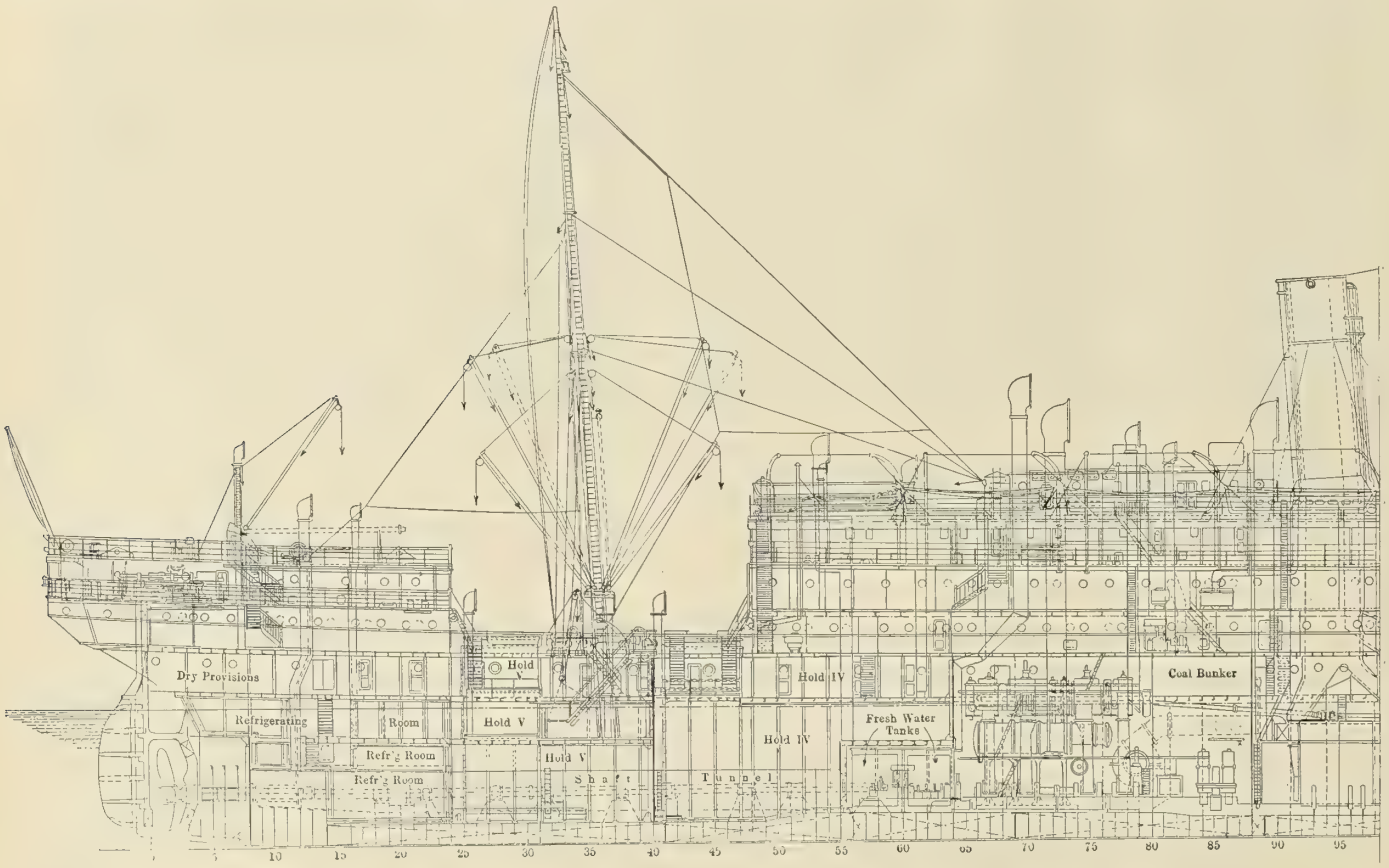
The promenade deck has a stringer plate 5/16 inch and a balance of 7/32 inch in thickness.

On the main deck the stringer plate angle at inside edge of frames is continuous, and measures 3¾ by 4¾ by ½ inches. Intercostal angles of the same size connect the stringer to the shell plating. The same size intercostal angles connect the upper deck stringer plate to the shell plating, but the continuous stringer angle at inside edge of frames is larger, being 5⅛ by 3⅛ by 9/16 inches. On the bridge deck the continuous stringer angle is 4 by 4 by 7/16 inches, while the intercostal angles are 3⅛ by 3⅛ by 11/32 inches. The frames end at the lower side of the promenade deck. On this deck the angle connecting the stringer to the side plating measures 3½ by 3½ by 11/32 inches, while an inner angle, forming with the outer a waterway 12 inches wide, measures 2½ by 2½ by 9/32 inches, and is backed up against the wood deck sheathing. On the boat deck a similar 12-inch waterway is formed by an upper stringer angle 3⅛ by 3⅛ by 5/16 inches, connecting to a vertical tie plate 19¾ inches by 16 pounds; and an angle 2½ by 2½ by ¼ inches, backing up against the wood deck.

On the main deck, channel beams are placed at every frame. Where the length of the beam is as much as three-fourths the midship beam, these measure 7⅞ by 7/16 by 3 9/16 by ⅝ inches. For the shorter beams, the channels measure 7⅞ by 13/32 by 3 9/16 by ⅝ inches. At the side of hatchways and engine and boiler casings the smaller size is used. At the ends of hatchways, on main and upper decks, are channels 11¾ by 19/32 by 4 by ⅝ inches. Each of these beams is fastened to the corresponding frame by a gusset plate measuring 18 by 18 inches by 16 pounds, which is increased on the beams at side of hatches to 29½ by 29½ by 24 pounds. In way of web frames these plates are 19¾ by 19¾ inches by 18 pounds.

The beams on the upper deck are also channels located at every frame, and fastened to the frames by gussets of the same size as for the main deck. For beams of three-fourths the midship beam and over, the channels are of the size given above for the shorter channels on the main deck. Where the beams are less than three-fourths the midship beam, the channels are 6½ by 13/32 by 3 9/16 by 19/32 inches. The short beams alongside the hatches and casings are of this latter size.

The beams on bridge deck are located on alternate frames, and are turned down at the end for fastening to the frames. For the forecastle deck beams, these are channels 8 9/16 by 15/32 by 3¾ by ⅝ inches; for bridge deck beams proper, there are tee bulbs 9 7/16 by 5½ by 15/32 inches; for poop deck beams there are bulb angles 8 9/16 by 3½ by 9/16 inches. On the promenade deck, bulb angle beams measuring 7⅞ by 3⅜ by ½ inches are located on alternate frames. On the boat deck, bulb angle beams 6½ by 3 by 7/16 inches are located on alternate frames.



AFTER HALF OF THE INBOARD PROFILE OF THE KRONPRINZESSIN CECILIE, SHOWING MACHINERY LAYOUT.

Web frames are fitted at intervals of from four to six frame spaces, between the collision bulkhead and the after end of hold No. 4, being omitted, of course, where 'thwartship bulkheads take their place. These frames consist of plates 21⅜ inches by 20 pounds, cut by the three regular side stringers, which run continuously. Besides the continuous angles, which these stringers carry throughout the length of the vessel, and the intercostal angles against the side plating, there are fitted at each junction of a side stringer and a web frame, diamond plates measuring 36½ by 29 inches by 20 pounds. At the inner edge of the web frame are located double angles intercostal between the stringers, and measuring 4 by 4 by ½ inches.

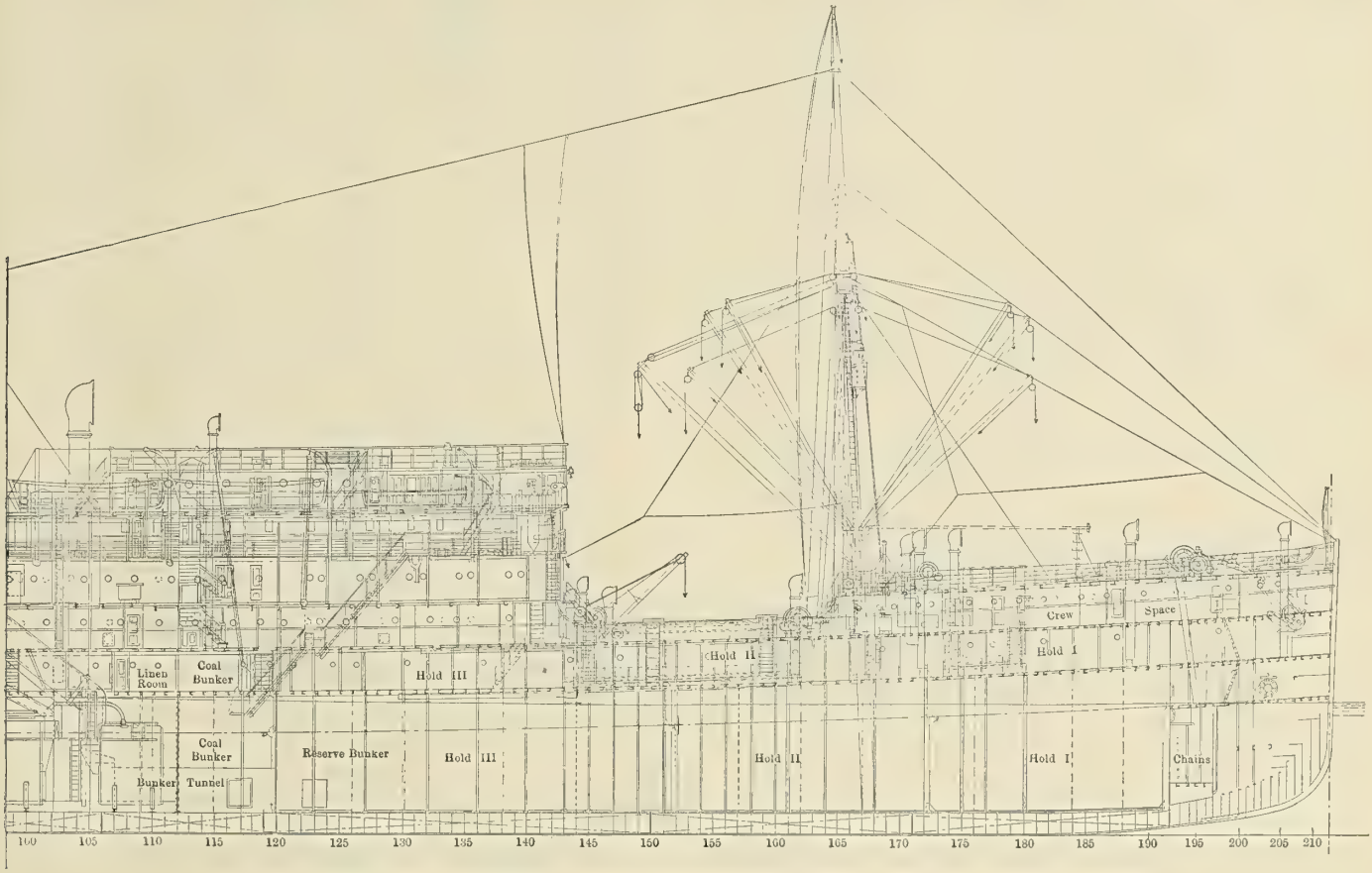
Cylindrical pipe stanchions, 5¼ inches in diameter and reaching from the double bottom to the main deck, are fitted on alternate frames in the after part of the ship, their place being taken forward by a steel center line bulkhead, varying in thickness from 10 to 14½ pounds. Between the main deck and the

upper deck are cylindrical stanchions on alternate frames and measuring 3¼ inches in diameter. Alongside hatches these stanchions, both below and above the main deck, are of the same size as otherwise, but they are placed at the side of the hatch in each case, instead of on the center line. Side stanchions of the same sizes are located about half way between the center line and the side of the ship, and are spaced on every four frames, both below and above the main deck; alongside the hatches these are spaced on alternate frames. A channel stringer under the main deck beams and alongside the side stanchions measures 7⅞ by 7/16 by 3 9/16 by ⅔ inches, and is continuous. The center line stanchions below the main deck carry along their tops a channel of this same size, and they are located alternately to port and starboard of this channel, as shown in the drawing of the midship section.

The fore-and-aft center line bulkhead is constructed of steel plates, which have a thickness between upper and main decks, of 10 and 11 pounds per square foot; between main and 'tween decks, of 11 and 13 pounds; between 'tween decks and tank top, of 13 and 16 pounds. The upper portion is stiffened by angles 4½ by 2 9/16 by ⅔ inches; the central portion by angles 6 11/16 by 3 by 7/16 inches, and the lower portion by channels 10¼ by ⅜ by 3¾ by ⅝ inches.

In the double bottom the floors are flanged 4 inches at both top and ends for connection to the sister keelsons and to the tank top. Connection to the margin plate is made inside by an angle 4 by 4 by ½ inches, with double angles outside. Single angles of this same size run fore and aft at the upper and lower sides of the sister keelsons. The floor plates are connected to the center vertical keelson by double angles of this size. In the boiler room the sister keelsons are located only half as far apart as in the holds. They are flanged at sides only, being connected to the tank top by double angles 4 by 4 by ½ inches. The fore-and-aft angles at top and bottom are single and of the same size. Connection to the margin plate is the same as in the cargo spaces.

Under the engine room the double bottom is deeper than elsewhere and has heavier tank top plates. Another difference is that these plates have butt joints with butt straps on top, instead of the lap joints prevailing elsewhere. The floors are connected as before to the sister keelsons by vertical flanges on the floors themselves. The transverse angles along the top of floors measure 5⅛ by 4 by ⅔ inches. Lightening holes, 24 inches in diameter, are fitted in the floors under the engine room in each compartment. In the boiler room these holes are elliptical, 20 by 24 inches. In the holds they are the same size as under the engine room, but are located two in each compartment.



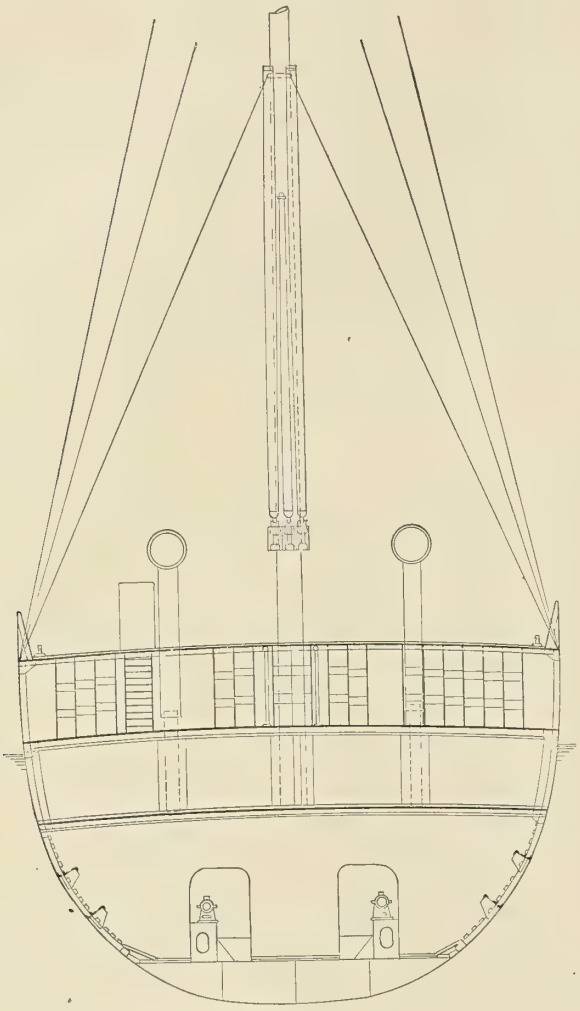
FORWARD HALF OF THE INBOARD PROFILE OF THE KRONPRINZESSIN CECILIE, SHOWING LOCATION OF HOLDS.

The double bottom, which measures 4 feet deep in the center of the ship, is subdivided into nine watertight compartments, with a total capacity for ballast, feed and drinking water of 1,345 tons. In addition to this, two tanks for fresh water are fitted in the engine room, with a capacity of 40 tons, making the total possible water supply of the ship 1,385 tons.

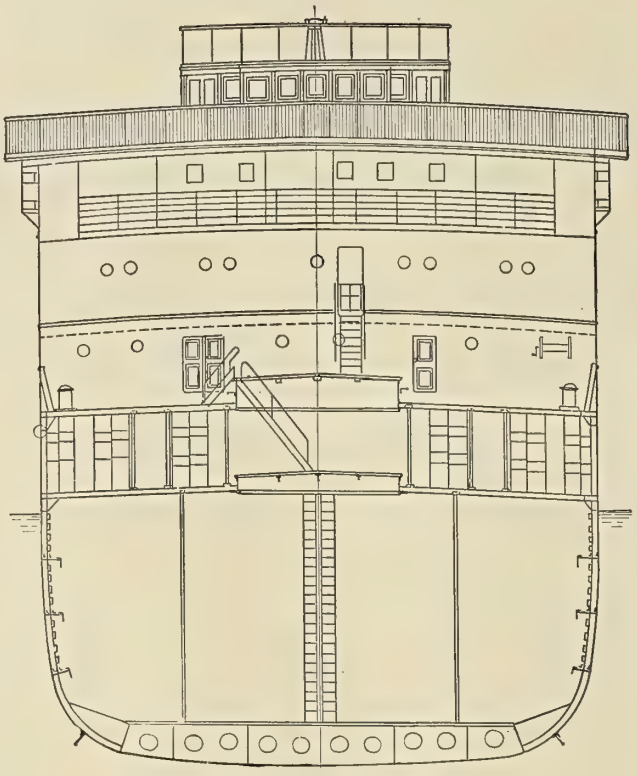
Coal bunkers are arranged in the hold and on main deck for a normal coal supply of 1,419 tons, which amount may be increased by reserve bunkers with a capacity of 572 tons.

The stern post is made of cast steel, properly riveted and secured to the outside plating and to the flat keel plating. Its lugs for taking the rudder pintles are bushed with lignum vitae. The brackets are joined with the stern post by scarfs and connected with the outside plating in a thoroughly substantial manner. These brackets form the aftermost margin of the bossing, allow the water to run off smoothly without forming eddies, and add little or nothing, in passing through the water, to the vessel's resistance. The stern post weighs 52,900 pounds.

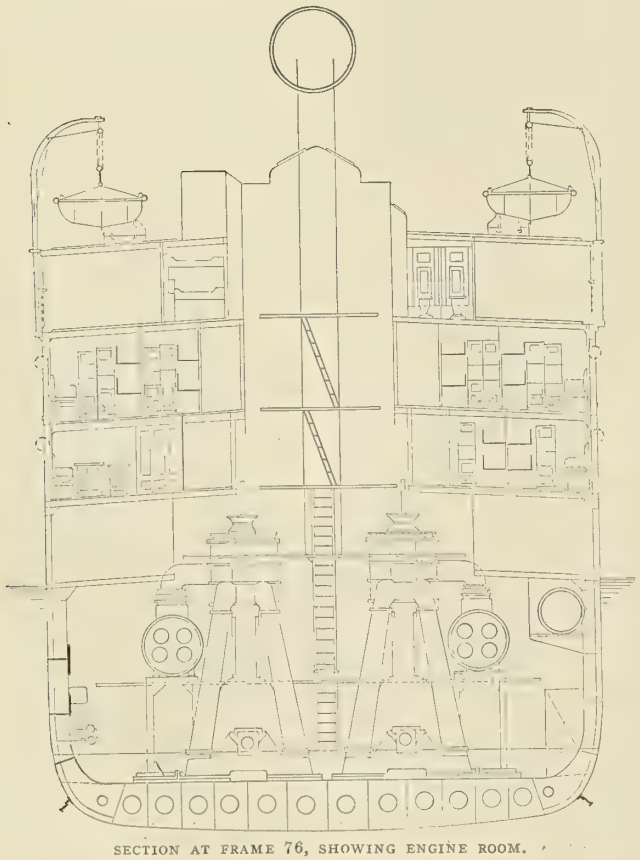
The rudder is of wrought iron. The main piece, which has



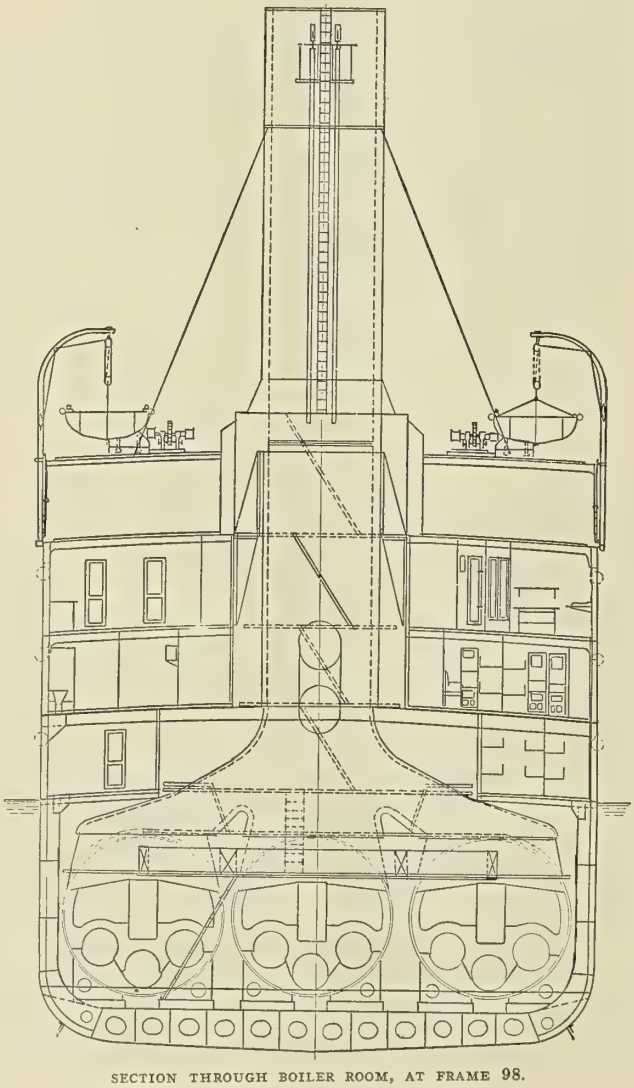
SECTION AT FRAME 38, SHOWING SHAFT ALLEYS.



SECTION AT FRAME 145, THROUGH HOLD III.



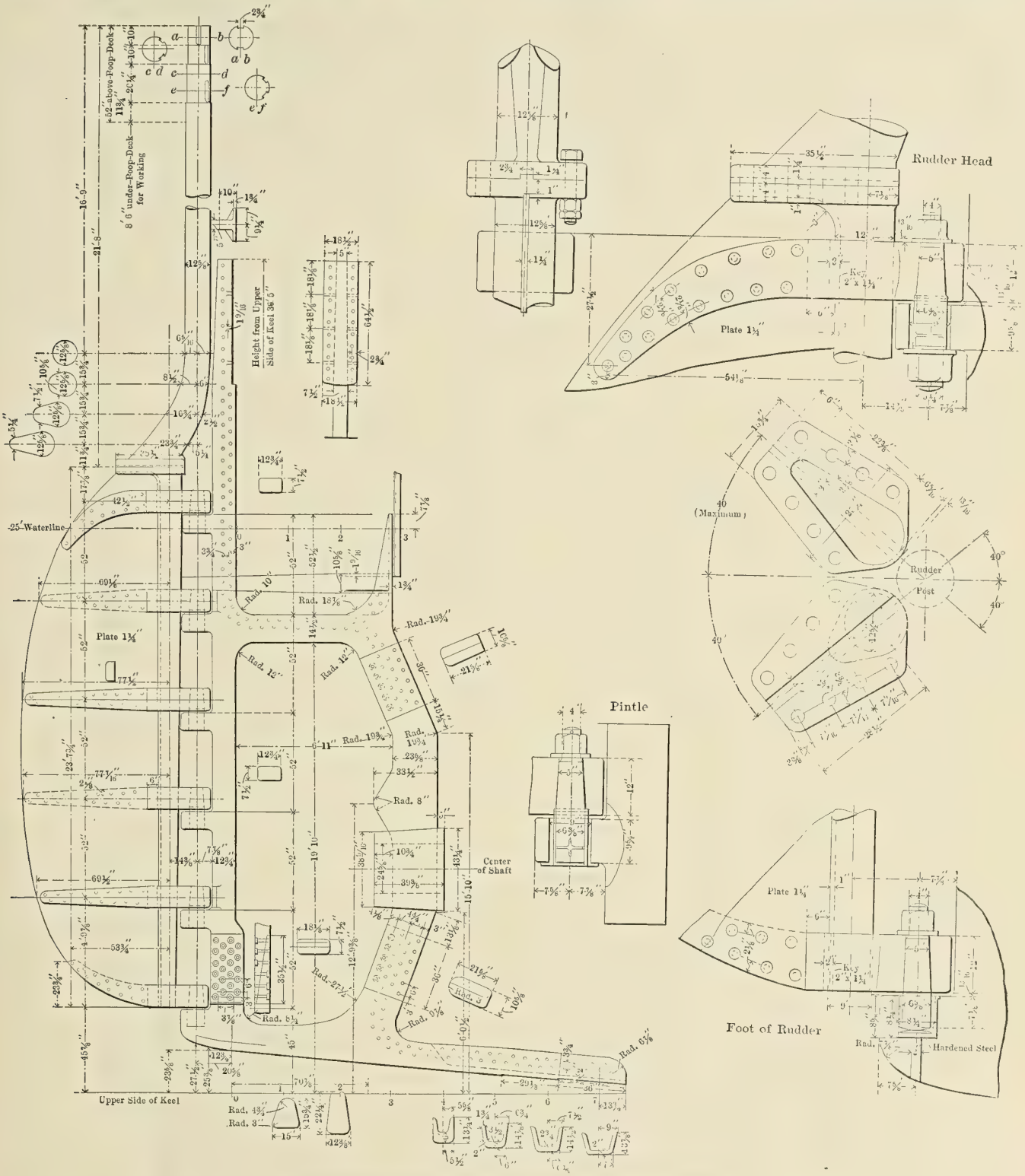
SECTION AT FRAME 76, SHOWING ENGINE ROOM.



SECTION THROUGH BOILER ROOM, AT FRAME 98.

a diameter of 12 19/32 inches on the upper end, is a forged shaft, tapered towards the heel, and jointed to a separate head. It is turned parallel in way of the arms, which are very accurately bored, shrunk on and secured against rotation by a key. A longitudinal groove, which takes the edge of the plate, serves as key-way for the arms. These, six in number, and situated at intervals of 52 inches, have a height of 12 inches. A horizontal coupling is situated above the waterline, so that the rudder can be dismounted without docking or unloading the ship. The rudder plate is 1¼ inches thick, and has an area of 147.46 square feet. The weight of the rudder, complete, is 40,311 pounds.

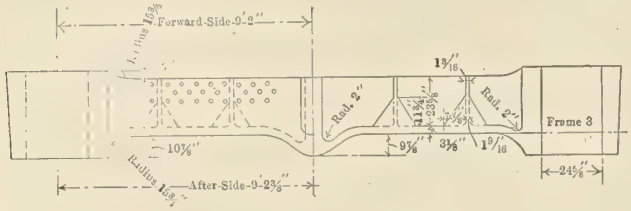
The deck spacing from top of beam to top of beam measures 8 feet from main deck to upper deck, and the same from upper deck to bridge deck. From bridge deck to promenade deck it is 9 feet, and from promenade deck to boat deck 8 feet. Wood deck planking is fitted on the upper, bridge, promenade and boat decks, being 5 by 3-inch Oregon pine on the upper deck; 5 by 3-inch Oregon pine in superstructures, and teak of the same size outside on the bridge deck. On the promenade and

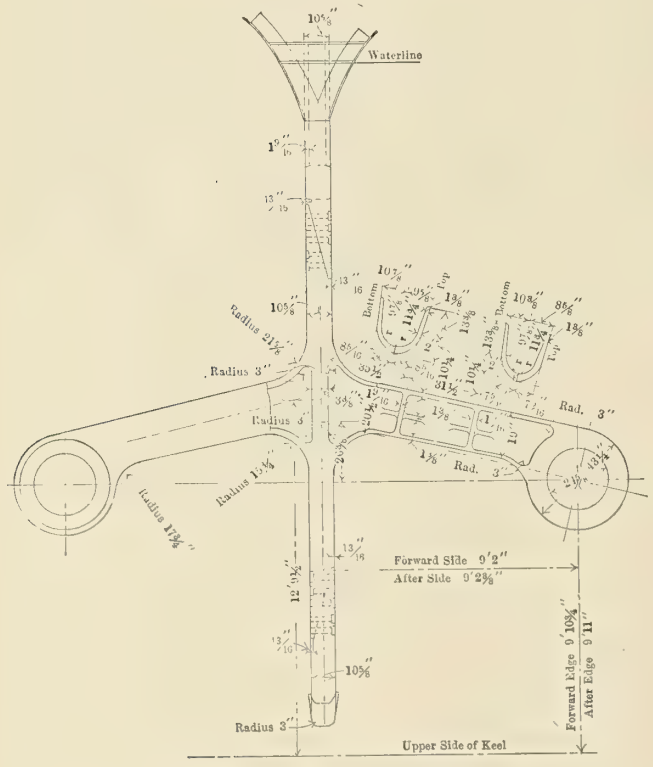


DETAILS OF THE STERN POST, RUDDER POST, RUDDER AND PINTLES.

boat decks are 2½-inch Oregon pine in superstructures and 2½-inch teak outside.

The ship has three Hall's patent anchors, weighing 11,750 kilograms (25,900 pounds) each, with 295 fathoms anchor chain of 2½ inches diameter; one stream anchor





THE SPECTACLE FRAMING OR STRUTS.

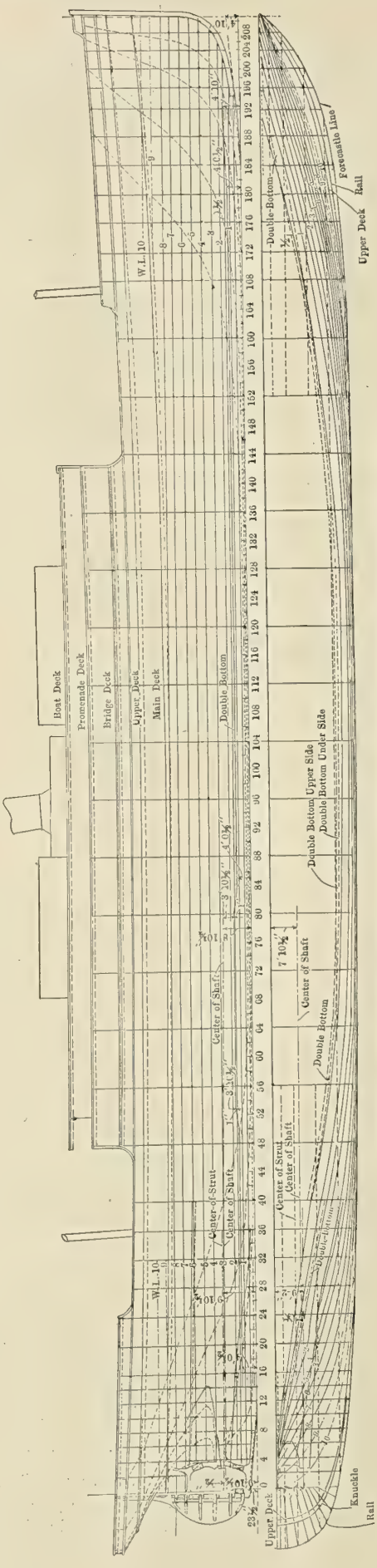
of 1,370 kilograms (3,020 pounds), and one kedge of 685 kilograms (1,510 pounds). The two latter are of Trotmann's make, while the anchor chains have been delivered by Hingley. These include the above 295 fathoms, and also 112 fathoms each of steel cable 5¼ inches in circumference, and steel cable of 4 inches, and 225 fathoms of 8-inch hemp cable. There are in all sixteen lifeboats, ten of which measure 28 feet by 8 feet by 3 feet 5⅜ inches; one measures 26 feet by 7 feet 8 15/16 inches by 3 feet 3 inches, and the other five are semi-folding boats of 26 feet 3 inches by 7 feet 10½ inches by 17 11/32 inches. Besides these, there is one working boat of 19 feet 3½ inches by 5 feet 7¾ inches by 27 9/16 inches.

The machinery will be described in January.

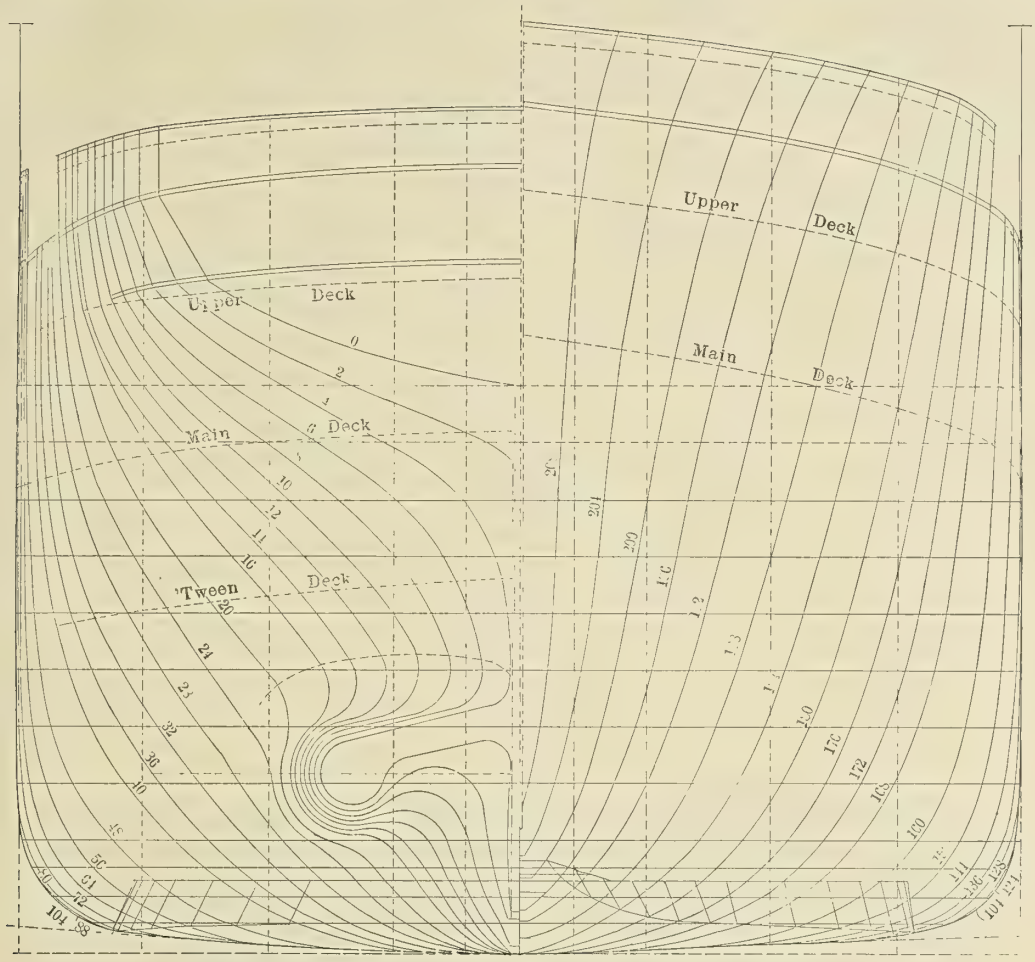
The First French Turbine Steamer.

BY JULES PELTIER.

On Sept. 23 there was launched from the yards of the Chantiers de St. Nazaire, Penhouet, France, the turbine steamer *Charles-Roux*. Some difficulty was occasioned by the fact that the ship stuck on the ways, but she was later floated in good shape. This ship was built under a subsidy from the French government amounting to 140 francs (£5-11/, or



WATERLINES AND BUTTOCK LINES OF THE HAMBURG AMERICAN STEAMSHIP KRONPRINZESSIN CECILIE.



BODY PLAN OF THE KRONPRINZESSIN CECILIE, SHOWING DOUBLE BOTTOM.

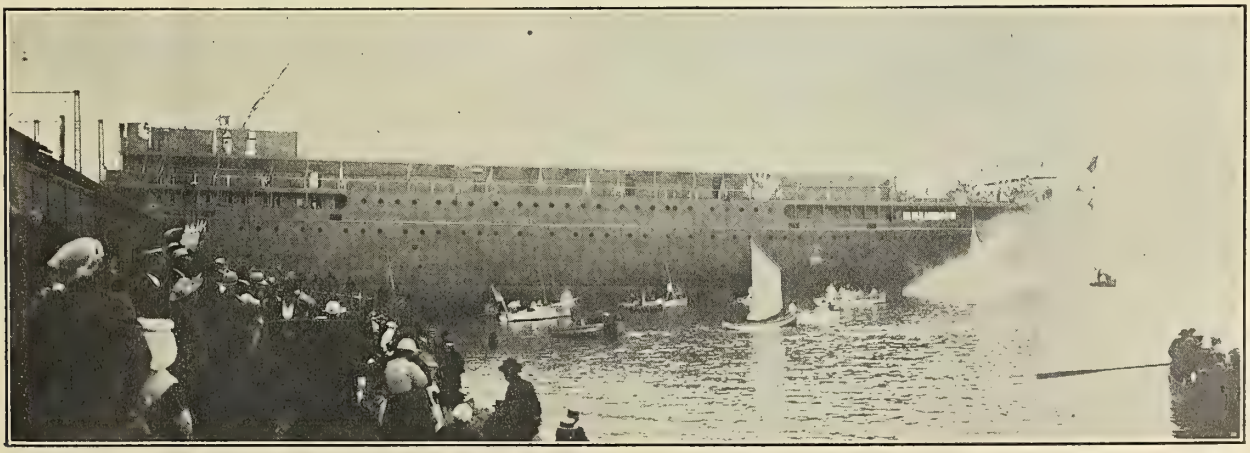
$27.02) per gross ton register, and 267½ francs (£10-13-5, or $51.63) per ton of machinery.

The steamer has the following dimensions:

	Meters.	Feet.
Extreme length	122.1	401
Length between perpendiculars	116.38	382
Extreme beam	13.9	45.6
Depth to promenade deck	11.25	37
Draft, mean	5.4	17.7
Draft, aft	6.2	20.35

The displacement, fully loaded, is 4,600 tons, the expected speed with 10,000 horsepower furnished by Parsons turbines being 20 knots. The cubic capacity available for cargo is 1,600 cubic meters (56,600 cubic feet, or 1,415 register tons). The volume of the bunkers is 400 cubic meters, this being equivalent to a stowage of 329 tons of coal.

The hull is built of Siemens-Martin steel, with a double bottom running from bow to stern and divided into cellular compartments. There are twelve watertight compartments separated by watertight bulkheads and pierced by watertight doors, which may be closed from the navigating bridge in about twenty seconds. There are three complete decks running from end to end, while above the spar deck are the promenade deck and the boat deck, and above the latter are the quarters for the officers and the navigating bridge. The accommodations for passengers and crew are on the main,



LAUNCHING OF THE CHARLES ROUX, THE FIRST FRENCH TURBINE-PROPELLED STEAMER.

spar and promenade decks, the crew's quarters, with petty officers' rooms and infirmary, being, as usual, forward, while aft are the quarters for third class passengers. The engineers and firemen are located in way of the engines, while the galleys are around the funnels.

The central part of the ship has been devoted to the first and second class passengers, the first class having a large drawing room with piano, a ladies' room, writing room and smoking room. Below the drawing room is the dining saloon, which seats 110, and is fitted with small tables seating from two to ten persons each. The furnishings are of Louis XVI. style. The first class staterooms are very luxurious, with furnishings of ash and sycamore. The one cabine de luxe is just aft of the drawing room, and includes parlor, bedroom and bath.

The second class passengers are located further aft, and have at their disposal a drawing room and smoking room on the promenade deck, and a dining room on the spar deck, seating 60. All their cabins are well fitted up, none having more than three beds, while many have only two.

All cabins of both classes are lighted by electricity, with ventilation and heating on up-to-date lines. Heating is by low-pressure steam, a temperature of 18 degrees Centigrade (64½ degrees Fahrenheit) being easily maintained. In the first class drawing room and some other compartments are fitted electric heaters. Ventilation is aided by electric fans, each passenger being able to regulate matters in his own stateroom to suit himself. The light ports are of the Stone patent ventilating type. The bathrooms are supplied with hot and cold water.

The two cargo holds and the baggage room are fitted with winches of from 2½ to 3 tons effective lifting power, operated by electricity. Aft on the spar deck is a special compartment for the stowage of motor cars, which in winter are carried in large numbers from France to Algeria.

The main engines consist of five Parsons turbines operating three shafts. Two of the turbines are fitted for moving astern, these being on the outboard shafts, while each shaft has one ahead turbine. At full speed the revolutions will be 440 per minute, and the crossing from Marseilles to Algiers is expected to occupy about twenty hours. The propellers have a diameter of 1.9 meters (6 feet 3 inches) and a pitch of 1.7 meters (5 feet 7 inches), the pitch ratio being thus 0.895.

Steam is supplied by eight single-ended Scotch boilers, 11 feet 2 inches in length and 12 feet 10 inches in diameter, with four fire rooms. The working pressure is 11 kilograms per square centimeter (157 pounds per square inch). The total grate surface is 57 square meters (614 square feet), while the heating surface is 2,200 square meters (23,690 square feet). The ratio is thus 38.6 to 1. Howden's forced draft system is fitted.

Two dynamos driven by steam turbines supply current for 900 electric lights, besides the electric fans and winches. The ship is supplied with steel lifeboats hoisted by electric winches

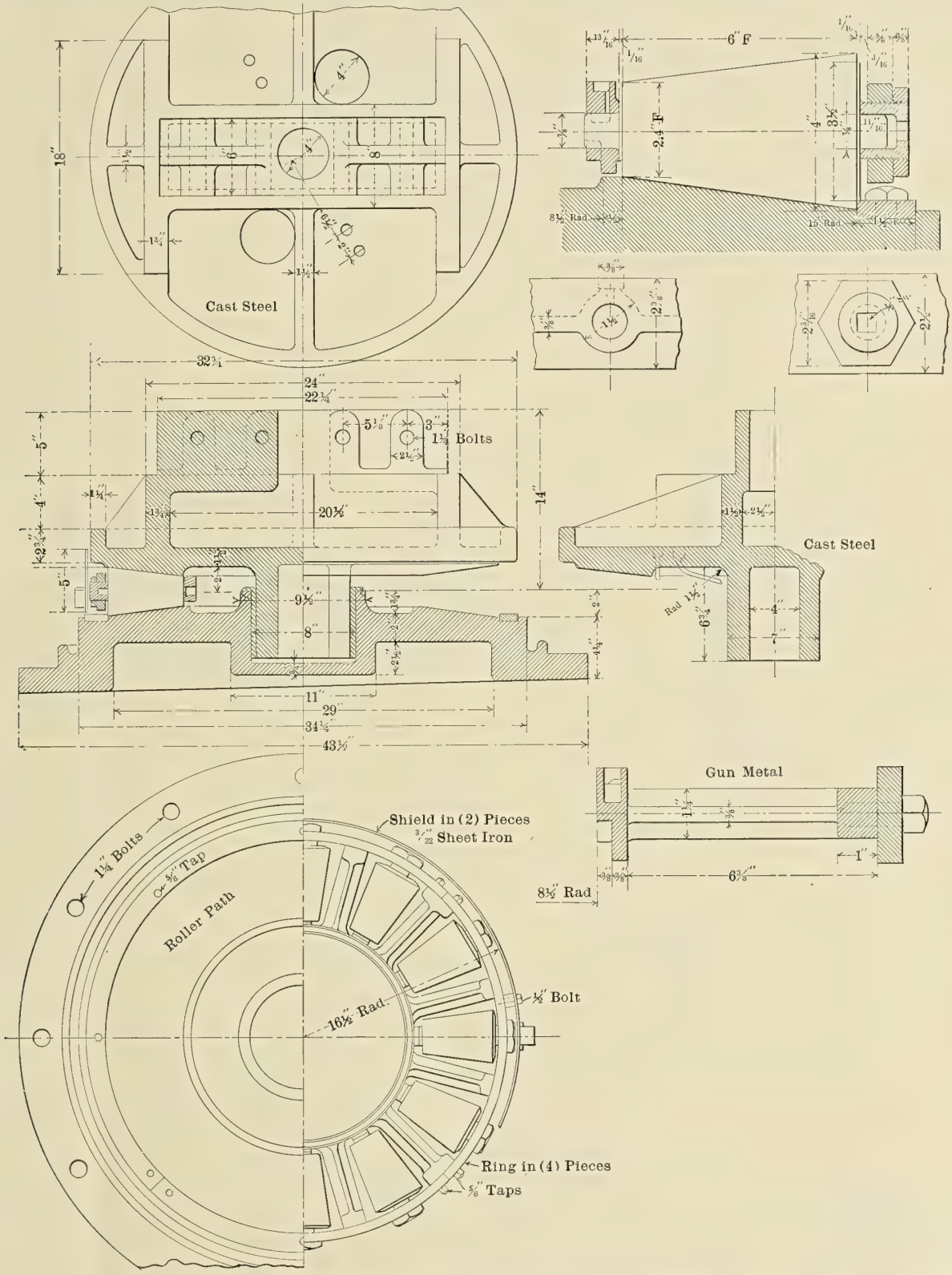
STERN, JUST BEFORE LAUNCHING. NOTE THE THREE DIMINUTIVE PROPELLERS.

and supplied with Welin quadrant davits, which makes it possible to launch them in forty seconds with the use of only four men.

The total passenger complement is 205 first class, 70 second class and 54 third class, making an aggregate of 239. The crew includes 10 officers, 18 seamen, 56 in the engineering department and 26 in the steward's department, making a total of 110.

NOTES ON BOAT AND ANCHOR CRANES. II.

The remaining drawings show details of electrically operated cranes for the handling of boats and anchors on warships. They represent practice covering the last eight or ten years, and are given in considerable detail.



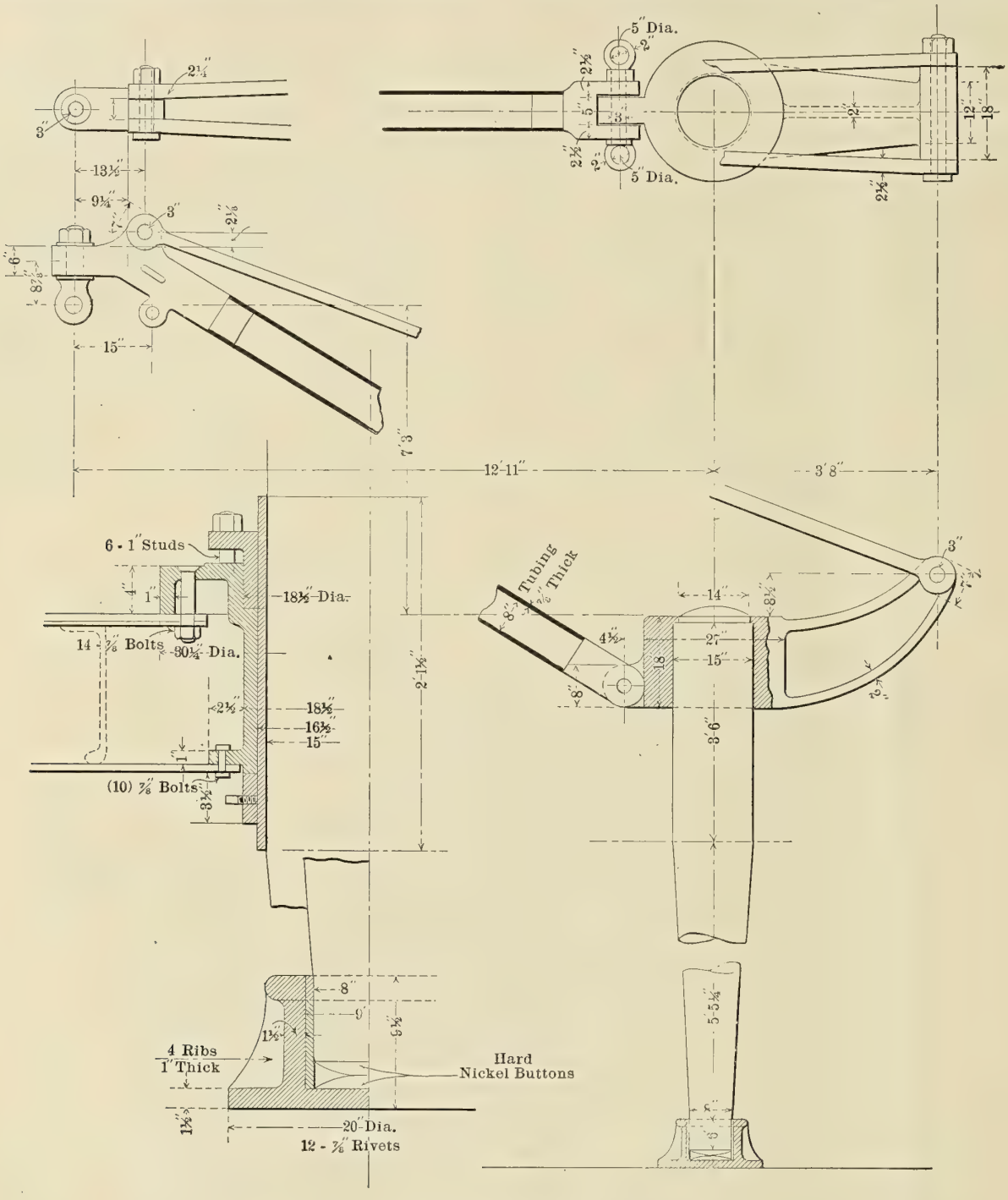
DETAILS OF STEP FOR BOAT CRANE OF UNITED STATES BATTLESHIP OHIO.

The step for the boat crane of the battleship *Ohio* is shown in the first drawing, it being similar to those previously described. The roller path has an outside radius of 15 inches,

the rollers being 6 inches long. The roller diameters are 4 and 2.4 inches, respectively, outside and inside. The foot of the crane, and the bearing on which it operates, are of cast steel. The dimensions are given in the drawing.

An anchor crane for a battleship is shown in another drawing. The total weight is 11,177 pounds, of which the spindle or stock accounts for 4,080; the spreader casting for 3,030; the jib for 1,850 and the tie rods for 658 pounds; smaller items making up the total. The radius of action of this crane is 12 feet 11 inches. The spindle is carried down into a steel casting on the gun deck, and is fitted at the end with a hard nickel steel spherical piece registering upon a similar one, reversed in position.

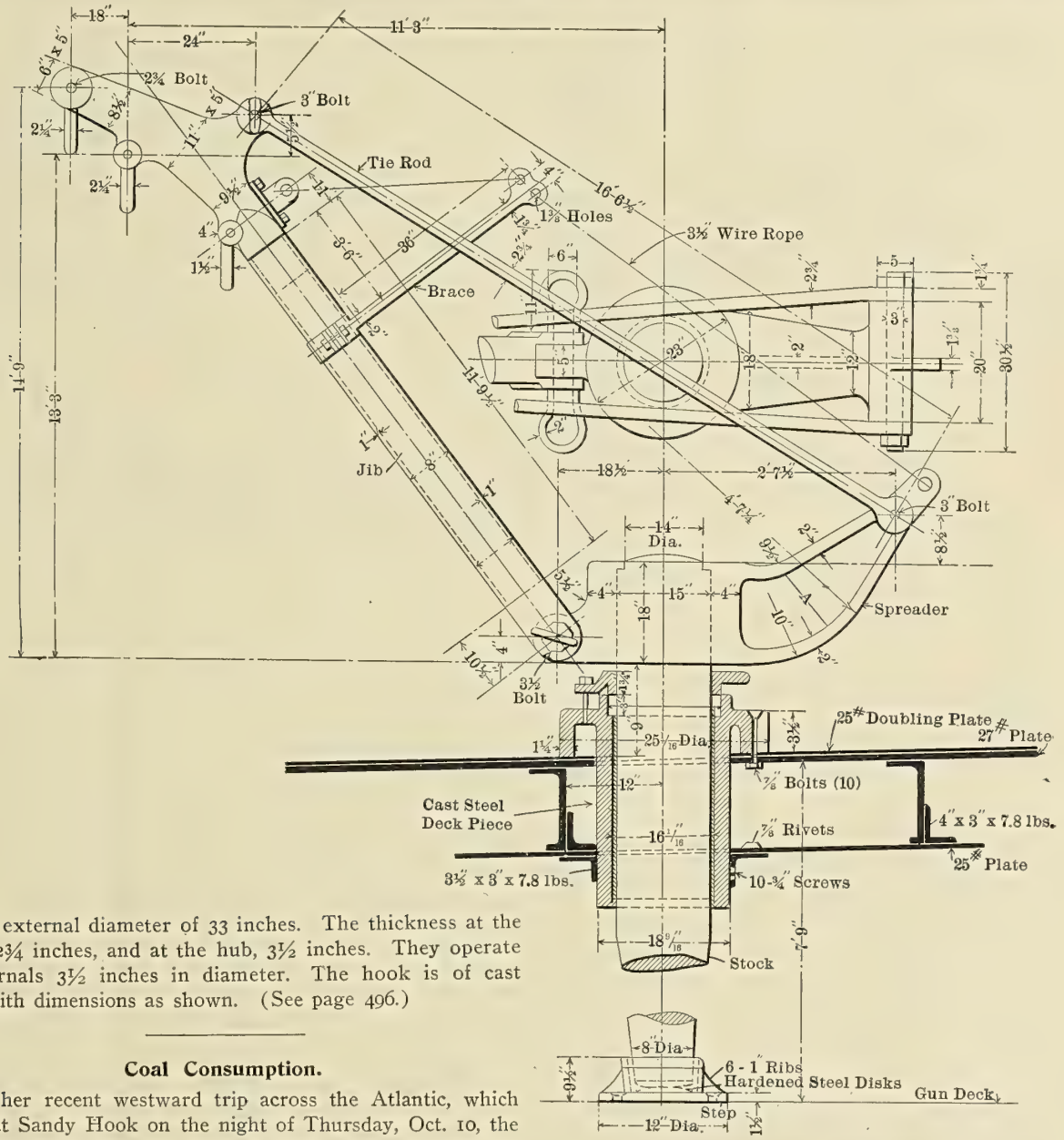
Another drawing shows a crane designed for handling a 16,500-pound anchor and 2⅝-inch chain on the armored cruiser *California*. The weight of this crane complete is 11,396 pounds. Of this amount, the largest item is the stock, which weighs 4,293 pounds, and is of wrought steel, 15 inches in diameter at the head, tapering to 8 inches at the foot, where it is stepped into a bearing of cast steel on the gun deck. The jib weighs 2,532 pounds, the spreader, 2,245 pounds, and the tie rods, 751 pounds. Smaller items make up the total. The stress per square inch in the tie rods is figured at 4,800 pounds, the total tension being 57,000 pounds. Three hoisting shackles are fitted to the jib, the outer being at a radius of 12 feet 9 inches, and being swung 14 feet 9 inches above the lower face of the spreader. The second shackle is 13 feet 3 inches above the spreader, and 11 feet



DETAILS OF ANCHOR CRANE FOR BATTLESHIP, UNITED STATES NAVY.

3 inches from the axis. The stress in the jib just beyond the connection of the tie rod is estimated at 8,330 pounds per square inch when there is a load of 40,000 pounds on the outer shackle. The stress per square inch on the pivoting point in the lower section of the jib is estimated at 8,554 pounds, the total compression being 94,000 pounds. At section *A* of the spreader the stress is 2,720 pounds per square inch. The length of tie rods is 16 feet 6½ inches. Additional support is furnished by means of a 3½-inch wire rope passing over a brace, the whole forming a sort of hogging girder. The spreader, of cast steel, is shrunk on the stock.

Another drawing shows the head casting, sheaves and hook for the boat crane of the battleship *Ohio*. The two sheaves are both alike, of cast iron, with a pitch diameter of 30 inches and an external diameter of 33 inches. The thickness at the rim is 2¾ inches, and at the hub, 3½ inches. They operate on journals 3½ inches in diameter. The hook is of cast steel, with dimensions as shown. (See page 496.)



ANCHOR CRANE FOR ARMORED CRUISER CALIFORNIA.

Coal Consumption.

"On her recent westward trip across the Atlantic, which ended at Sandy Hook on the night of Thursday, Oct. 10, the *Lusitania* broke all speed records, both as regards time of passage, average speed throughout the trip, and number of miles run in a single day. The average speed was almost exactly 24 knots. This great speed record was attained by the use of an immense coal consumption, some 900 tons a day. * * * What will a 30-knot liner burn? In the *Coal Trade Journal* several years ago appeared a brief table which is worth repeating here, showing in round figures the consumption per increase of knotage up to 20 knots, as follows:

8 knots	8 tons per day
10 knots	16 tons per day
12 knots	32 tons per day
14 knots	64 tons per day
16 knots	128 tons per day
18 knots	256 tons per day
20 knots	512 tons per day

"But after 20 knots the coal consumption per extra 2 knots does not increase in a 'just double' ratio. Thus 22 knots would not require something like 1,024 tons. Due to the laws of velocity, momentum obtained, vacuo, suction, etc., after 20 knots the coal consumption per extra 2 knots can safely be said to 'progressively decrease.' So, in round figures, continue the above table, always adding the inverse ratio (starting with 50 percent increase) to the 20-knot, 512-ton rate, as follows:

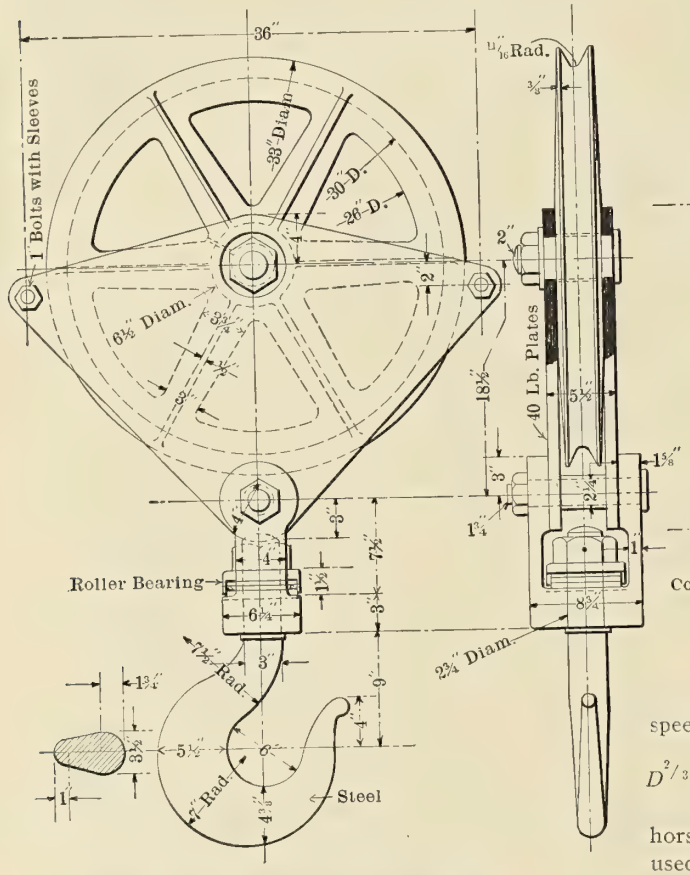
22 knots	768 tons per day
24 knots	896 tons per day
26 knots	960 tons per day
28 knots	992 tons per day
30 knots	1,008 tons per day

"Or, say, with allowances for contrivances, 1,000 tons in general figures for a 30-knot Atlantic racer. The value of this calculation is verified by the statement in the first paragraph, that the *Lusitania,* running at an average of 24 knots, has to use coal at the rate of at least 900 tons a day."

F. E. Saward, in *Iron Age.*

EDITOR'S COMMENT.

The above method of computation is entirely incorrect, and is not a little misleading, particularly to those whose training has not been along the special line of marine propulsion, and who, therefore, are unable to check the figures and to discover the errors. It is a little difficult to make proper correction

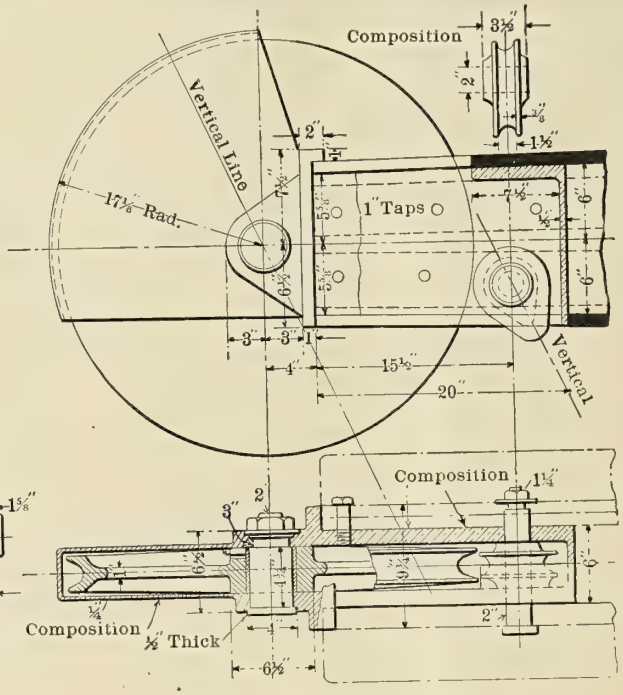


DETAILS OF BOAT CRANE FOR BATTLESHIP OHIO.

of this matter, because there is little information given for use as a basis from which deductions can be made. If the first section of the table is intended to apply to different speeds *for one and the same ship,* it is absolutely incorrect, and wholly unreliable. If it is intended to apply to *different* ships, increasing in size as the speeds increase, it may or may not be correct, according to whether or not the sizes of vessels are properly chosen. In any event, no information is given as to what these sizes are, and in the absence of such it is fair to assume that the figures were intended for vessels all of the same size and design. The second section of the table is much more incorrect than is the first, because the asumption is there made that the coal consumption of vessels at speeds above 20 knots will increase at an *inverse* ratio. This is very far from the case, as will be shown hereafter.

In general, the fuel consumption of a vessel does not vary much per indicated horsepower per hour for different powers and speeds. There is a considerable variation at extreme speeds in either direction, but for a vessel designed for 20 knots and upwards, the variation between 12 and 20 knots would be slight. The horsepower required for the propulsion of such a vessel at these varying speeds would increase about as the cube of the speed, the index of the power being greater usually as the speeds approach the maximum possible for the design. This being the case, the coal consumption would also increase about as the cube of the speed, and, in the absence of definite information to the contrary, we have constructed a table similar to the foregoing, and based on the ship at 20 knots with a coal consumption of 512 tons per day.

A consumption of 512 tons per day is equivalent to 47,787 pounds per hour, and, as a steamer with good economy will use about 1.5 pounds of coal per horsepower per hour, the horsepower of this steamer figures out at 31,858. Assuming the vessel to have easy lines and to be designed for a high



HEAD CASTING AND UPPER SHEAVE.

speed, we will figure out her displacement from the formula $D^{2/3} = \frac{H\,K}{V^3}$, where D is the displacement in tons; H is the horsepower; V is the speed in knots, and K is a coefficient used for designing purposes, and known as the Admiralty coefficient. This coefficient is not constant, but for moderate results it is nearly enough so for our purposes. For the ship in question we will assume it to be 250. On this basis, D becomes 31,435 tons, which is somewhat below the displacement of the *Lusitania* at sea.

Knots.	Horsepower.	Tons Per Day
8	2,039	33
10	3,982	64
12	6,881	111
14	10,927	176
16	16,311	262
18	23,225	373
20	31,858	512
22	42,403	681
24	55,051	885
26	69,992	1,125
28	87,418	1,405
30	107,521	1,728

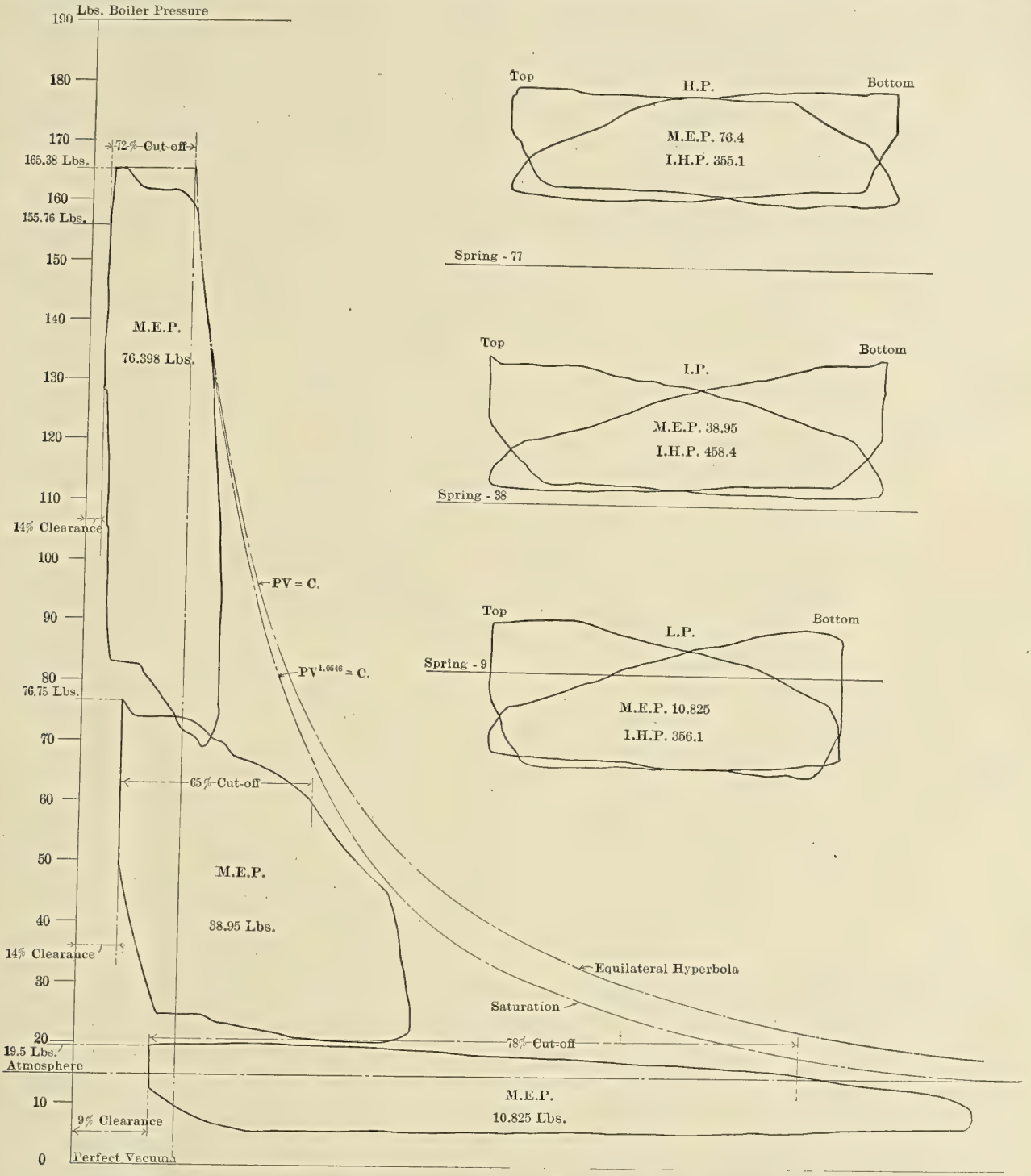
Our table is constructed for both the lower speeds and the higher speeds, on the assumption that both the horsepower and the coal consumption vary as the cube of the speed. As

explained above, this assumption is not entirely tenable, but it is the best at hand. It will be seen that the consumption at 24 knots is given in the original table at 896 tons per day, and in our table at 885 tons. For the purposes of comparison, these figures are practically identical, and both are close enough to the reputed coal consumption of the *Lusitania* at 24 knots to furnish some sort of proof as to their correctness. For 22 knots, however, the original table shows a consumption almost 100 tons per day greater than does our table, while for 26 knots the original table is 165 tons below ours, and for 30 knots, nearly 700 tons too small. It is needless to say that the computations from which the original tables were made started on entirely wrong assumptions and achieved totally erroneous results.

THE STEAMSHIPS DELAWARE AND PAWNEE. II.

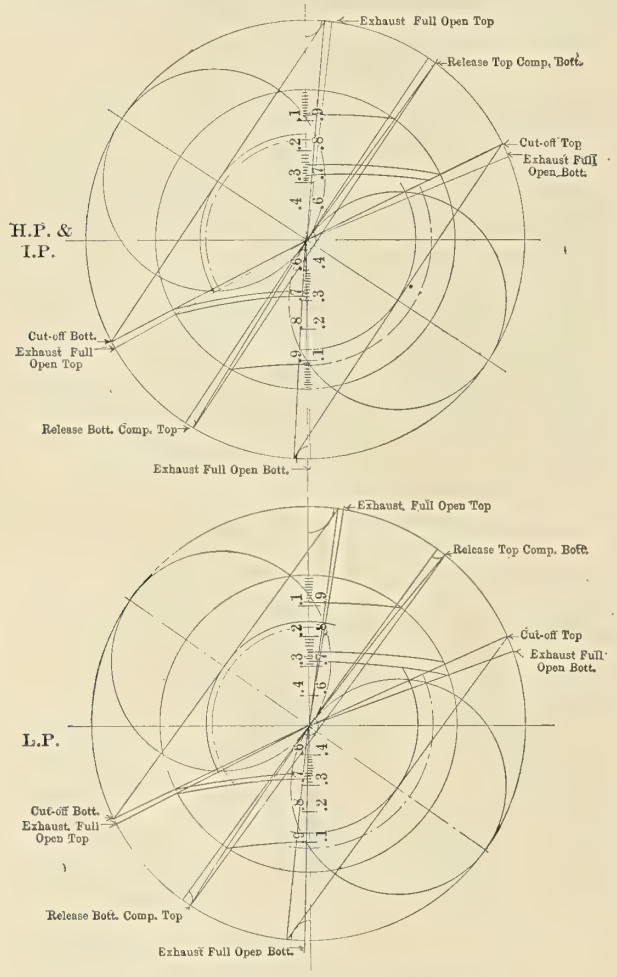
BY CHARLES S. LINCH.

The valve diagrams of the *Delaware* are made from an eccentricity of 2¾ inches for each cylinder, with a corresponding valve travel of 5½ inches, the cylinder diameters being respectively 19, 30 and 50 inches, with a stroke of 30 inches. The high-pressure cylinder has one 9½-inch piston valve; the intermediate-pressure, two 9½-inch piston valves; the low-pressure, one double-ported slide valve, 49 by 31 7/16 inches, fitted with an 8-inch balance piston. The piston valves take steam on the inside and the slide valve on the outside. In each case the steam lap is 1 3/8 inches at top and 1 5/16 inches at bottom. The exhaust lap is ⅛ inch at bottom, and negative ⅛ inch at top. The angular advance for the low-pressure



INDICATOR CARDS AND COMBINED CARDS FROM ENGINE OF THE CLYDE LINE STEAMSHIP DELAWARE.

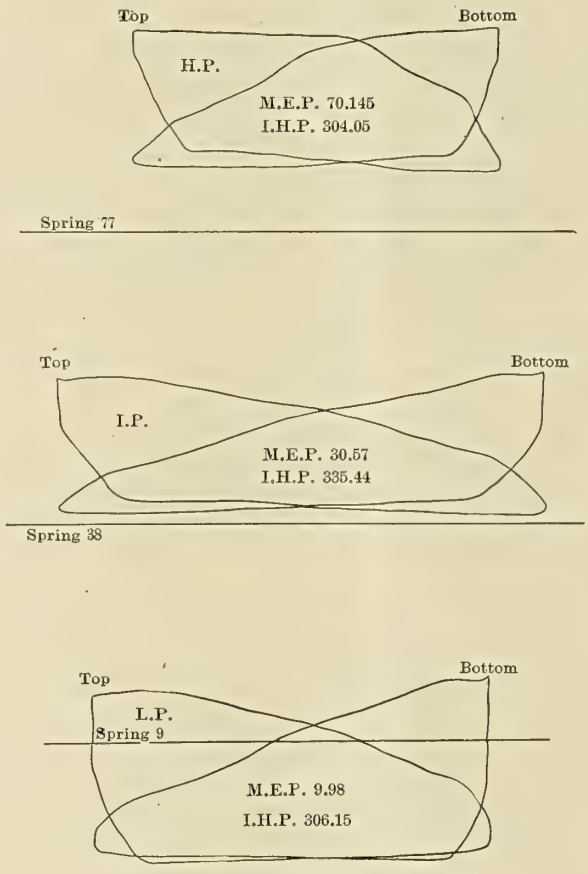
cylinder is 35 degrees 49 minutes; for the other cylinders 33 degrees 50 minutes. The steam lead in the low-pressure cylinder is ¼ inch top and 5/16 inch bottom; for the other cylinders it is 5/32 inch top and 7/32 inch bottom. The cut-off in inches for the low-pressure cylinder is 22½ inches top and 20 inches bottom, corresponding with 75 and 66⅔ percent. For the other cylinders it is 22 15/16 inches top and 20 9/16 inches bottom, corresponding respectively with 76.4 and 68.5 percent. Release for the low-pressure cylinder is at 2 11/16 inches top and 3 inches bottom; for the other cylinders, 2 5/16 inches top and 2⅝ inches bottom. The compression figures are the same, except that in each case the top and bottom are interchanged, as compared with the release. The steam opening in all cylinders is 1⅜ inches top and 1 7/16 inches bottom; while the exhaust opening in each case is full.



VALVE DIAGRAMS FOR THE DELAWARE.

The cards of the *Delaware*, from which the combined cards were drawn, are shown in one of the illustrations. The cylinder areas were, respectively, 283.5, 706.9 and 1,963 square inches gross, the mean areas being 276.4, 699.8 and 1,956.4 square inches. The indicated horsepower for the three cylinders was 1,169.6, the cut-off having been 72 percent in the high and intermediate, and 70 percent in the low-pressure cylinder. The boiler pressure was 188 pounds absolute; the vacuum 27 inches, and the revolutions 111 per minute. The engine constants for the three cylinders were, respectively, 0.04188, 0.10602 and 0.2964, the latter being the low pressure. The ratio of low-pressure to high-pressure piston area is 6.92; intermediate to high, 2.45; low to intermediate, 2.77. The total ratio of expansion was 9.58. The theoretical mean effective pressure due to this ratio is 63.3 pounds above the vacuum. Deducting 4 pounds for back pressure, we have 59.3 pounds per square inch. The mean effective pressure from the cards, referred to the low-pressure cylinder, is 35.87 pounds per square inch. The card factor thus figures out at 60.5 percent.

For the *Pawnee* it will be noted that two sets of cards are used, and the combined cards show the results for each case, one in solid lines, and the other dot-and-dash. In the first case the steam pressure was 190 pounds absolute in the boilers, with a pressure of 169 pounds in the high-pressure steam chest, 74 pounds in the intermediate receiver, and 25 pounds absolute in the low-pressure receiver. The vacuum was 24.5 inches. The revolutions were 111 per minute. Temperatures were as follows: feed-water, 198 degrees F.; hot well, 130 degrees; discharge water, 120 degrees; sea, 48 degrees. The ratio of expansion was 9.58; the theoretical mean effective pressure due to this ratio being 64.52 pounds per square inch. Deducting 4 pounds for back pressure, we have 60.62 pounds, which, compared with 35.67 pounds from the cards, gives a designing factor of 58.9 percent. The total horsepower was 1,162.1.



CARDS FROM ENGINE OF STEAMSHIP PAWNEE.

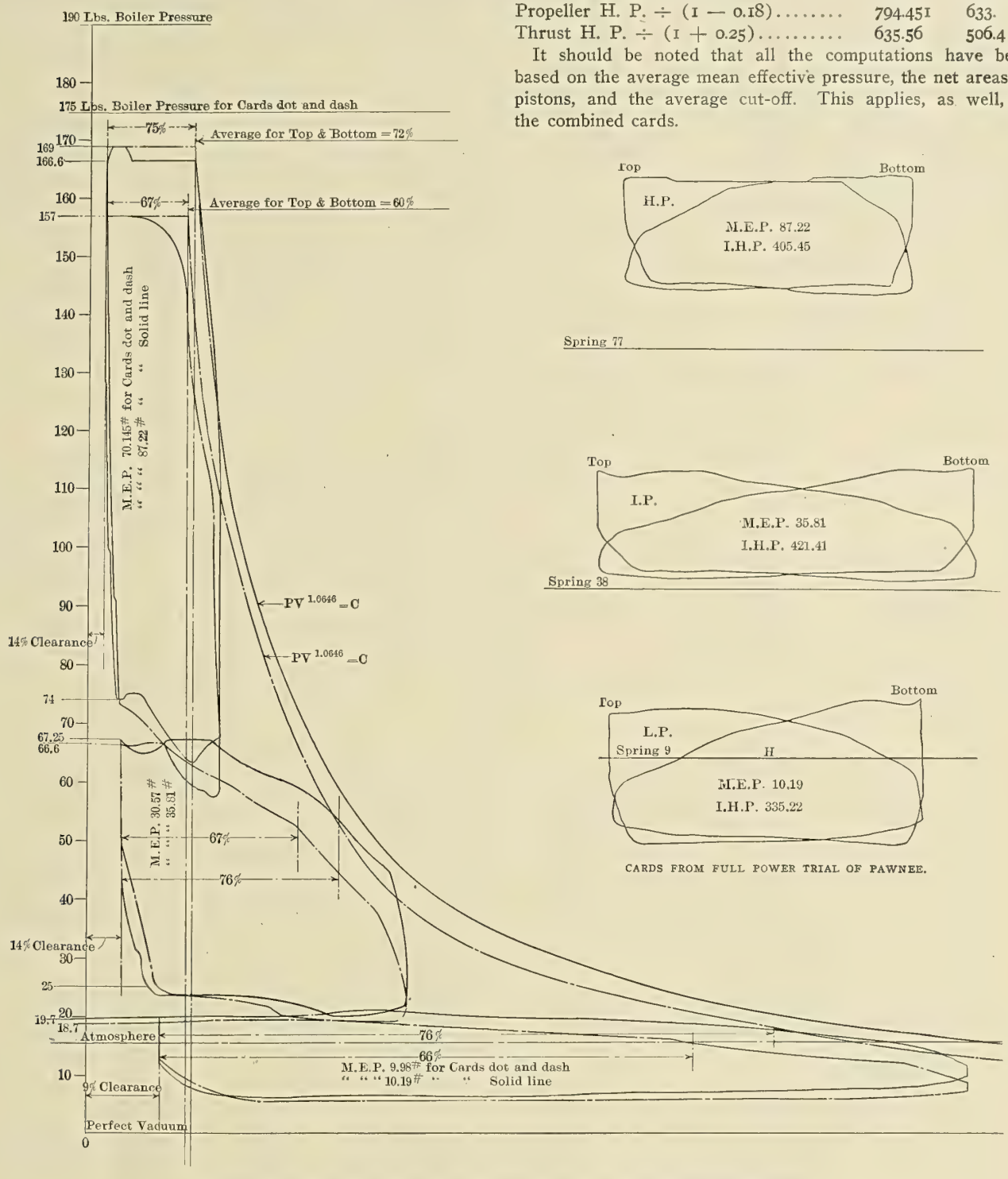
For the trial at lower power, the horsepower figured out at 945.6, with 103.5 revolutions per minute. The boiler pressure absolute was 175 pounds per square inch, with 157 pounds in the high-pressure steam chest. Temperatures were as before. The total ratio of expansion was 11.5, which corresponds with 52.39 pounds per square inch theoretical mean pressure. Deducting 4 pounds for back pressure, we have 48.39 pounds, which, compared with 31.1 pounds from the cards, gives a designing factor of 64 percent.

The latter of these two trials and the trial of the *Delaware* have been subjected to an analysis with the idea of determining the proportion of power absorbed by friction, and the

various losses incident to propulsion. Diagrams are given showing the results, which have been figured out on a basis of 87 percent mechanical efficiency of the engine, 63 percent efficiency of the propeller (64 percent for the *Delaware*), 25 percent loss by "augmentation" of resistance, and a corresponding gain of 18 percent from the wake. It will be noted that the constant derived from the last two factors is 1.025, corresponding with a hull efficiency of 97.5 percent. The propulsive coefficient, obtained by dividing the final effective horsepower by the indicated horsepower, is 54.3 percent in the case of the *Delaware*, and 53.4 percent in the case of the *Pawnee*.

	Delaware.	*Pawnee.*
Indicated horsepower	1,170.	947.
I. H. P. × 0.87 = Brake H. P.....	1,017.9	823.89
Brake H. P. × Propeller Eff.....	651.456	519.05
Propeller H. P. ÷ (1 — 0.18).....	794.451	633.
Thrust H. P. ÷ (1 + 0.25).....	635.56	506.4

It should be noted that all the computations have been based on the average mean effective pressure, the net areas of pistons, and the average cut-off. This applies, as well, to the combined cards.



CARDS FROM FULL POWER TRIAL OF PAWNEE.

COMBINED INDICATOR CARDS FROM TWO SETS OF RUNS WITH THE STEAMSHIP PAWNEE.

ANALYSIS OF PROPELLER FROM TRIAL DATA.

Speed of *Delaware* at load draft, with corrections made for tide, etc..... 11.5 knots
Indicated horsepower,..... 1,170.
Engine friction, 13 percent,..... 152.1 H.P.
Delivered or brake horsepower, 1,170 — 152.1 = 1,017.9

Apparent slip was 15 percent; true slip, 28 percent; wake factor, 18 percent.

$1 - S_1 = \frac{101.3 \times 11.5}{0.85} = 0.85$, where S_1 is the apparent slip.

$\frac{101.3 \times 11.5}{0.85} = 1{,}370.5$ = apparent speed of propeller in feet per minute.

$P'N' = \frac{PN}{100} = 13.705$, where P is the pitch in feet, and N the number of revolutions per minute.

$(P'N')^3 = 2{,}574.2$

From table*, k, a factor depending upon the slip = 0.206
From table, l, a factor depending upon pitch ratio = 0.803
From enlarged diagram, m, a thrust factor = 1.04
From drawing, i, a factor depending upon shape of the blade = 0.965

Now, delivered horsepower = $(P'N')^3 \times (d')^2 \times (i\,k\,l\,m)$, where d' is one-tenth the diameter in feet.

$\therefore 1{,}017.9 = 2{,}574.2 \times 0.965 \times 0.206 \times 0.803 \times 1.04 \times (d')^2$

whence $(d')^2 = 1.5386$; $d^2 = 153.86$ and $d = 12.4$ feet.

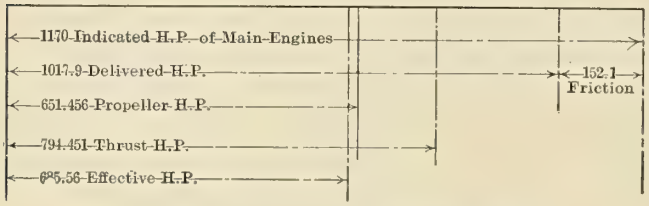
Now, $\frac{P}{d}$ = unity, and $P = 12.4$

$PN = 1{,}370.5$, and $N = 110.52$

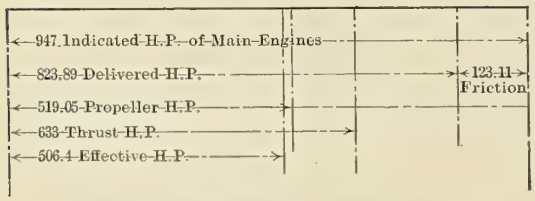
Friction of engine	= 1,170.	− 1,017.9	= 152.1 H.P.
Friction propeller, etc.,	= 1,017.9	− 651.456	= 366.444 "
Reactions, net	= 651.456	− 635.56	= 15.896 "
		Total losses	534.44 "

Propulsive coefficient $= \frac{635.56}{1{,}170} = 0.543$ or 54.3 percent.

Hull efficiency = 0.975, or 97.5 percent.



GRAPHICAL DISTRIBUTION OF POWER: DELAWARE.



GRAPHICAL DISTRIBUTION OF POWER: PAWNEE.

RESISTANCE.

Wetted surface, A, is 13,072 square feet at 15.5 feet mean draft.
Length between perpendiculars, 255.75 feet.
Load displacement, 2,840 tons.
Skin and wave resistances are R_s and R_w.

Horsepower absorbed by skin resistance, $P_s = R_s \times \frac{11.5 \times 101.3}{33{,}000}$

Horsepower absorbed by wave resistance, $P_w = R_w \times \frac{11.5 \times 101.3}{33{,}000}$

f, the coefficient of skin friction = 0.00933
c, a coefficient of wave resistance = 0.4
Then for the skin resistance, $R_s = \frac{f A V^{1.83}}{D^{2/3}}$
Then for the wave resistance $R_w = \frac{-}{L} \times c \times V^4$

$V = 11.5$, and $(V)^{1.83} = 87.31$

$\therefore P_s = 0.00933 \times 13{,}072 \times 87.31 \times 0.035313 = 376.043$

* W. F. Durand, *Resistance and Propulsion of Ships*, page 264.

$D = 2{,}840$, and $(D)^{2/3} = 200.55$; $V^4 = 17{,}490$.

$P_w = \frac{200.55}{255.75} \times 0.4 \times 17{,}490 \times 0.035313 = 193.682$

$P_s + P_w = 376.043 + 193.682 = 569.725$ horsepower absorbed in skin friction and wave-making resistance.

PROPELLER ANALYSIS.

Before closing this interesting subject, and to show the correctness of the data, I will take the above data and solve from characteristics from drawings. This treatment was that pursued by Barnaby, and published in the *Proceedings of the Institution of Civil Engineers*:

K = Constant, depending on I. H. P. and (R. P. M.)^2 and the fifth power of speed.

We have a wake of 18 percent. The computations were for 10 percent wake.

Speed, 11.5 knots − 0.08 × 11.5 = 10.58 knots, and $(10.58)^5$ = 133,820.

Substituting the known values, we have:

$$\text{Constant} = \frac{1{,}170 \times (111)^2}{133{,}820} = 107.4.$$

The constant for disk area is 116; for revolutions, 127. The (diameter)^2 becomes 144.6 square feet; the diameter, 12.02 feet; the pitch, 12.02 feet; the revolutions, 109.22 per minute.

The diameter as built was 12.3 feet; the pitch, as designed, 12.3 feet; the pitch, as cast, 12.25 feet; the revolutions obtained with throttle full open, steaming at above speed, 111 per minute.

Now, 12.3 − 12.02 = 2.28 percent, difference for diameter.
12.25 − 12.02 = 1.88 percent, difference for pitch as built.
111. − 109.22 = 1.6 percent, difference for revolutions.

If we had solved directly for constants, the result would have been the same. For all intermediate speeds and powers, with reduced draft, displacement, etc., the variations are the same throughout the range. Now, PN = 1,410, and N = 116.8. The PN as obtained was 1,387.5. The difference between this computation and the analysis is 1.6 percent. If we had substituted this difference in the early stage, the diameter computed and that as built would have been the same, namely, 12.35 feet.

The previous analysis having been made by the methods discussed by Professor Durand, we will take the data from another trial and analyze by Mr. Taylor's method.

Average speed corrected for tidal influence, 12.25 knots.

Engine and load friction, 13 percent, = 152.1 horsepower.

1,170 − 152.1 = 1,017.9 brake horsepower, or power delivered to propeller, = U.

Apparent slip 12 percent; true slip, 26 percent; wake factor, 18 percent.

Now, 12.25 × (1 − 0.18) = 10.045 knots, or 1,017.56 feet per minute. Now, $1 - S_2 = 1 - 0.26 = 0.74$, and $0.74\,PN$ = 1,017.56; whence PN = 1,375, and $\left(\frac{PN}{1{,}000}\right)^3 = 2.5996$.

Now, from the drawing we have the following characteristics: $X_t = 0.573$; $Z_t = 3.55$; $Y_t = 0.787$.

Mean width ratio from drawing, 0.17, = w. Number of blades = 4 = n. Thrust constant, a, = 7.4; coefficient of friction taken at 0.045. From the formula we have

$$U = 3 \times n \times \left(\frac{PN}{1{,}000}\right)^3 \times d^2 \times w\,(a \times S_2 \times X_t + f\,Z_t)$$

Substituting, we have
$1{,}017.9 = 3 \times 4 \times 2.5996 \times d^2 \times 0.17\ (7.4 \times .26 \times .573 + 0.045 \times 3.55) = 5.3 \times 1.262 \times d^2 = 6.688\ d^2$, whence $d^2 = 152.18$, and $d = 12.34$ feet, $= P$. $N = 1{,}375 \div 12.34 = 111.4$.

The wheel as built has a mean width ratio of 0.175; measurements taken from casting. Inserting this width ratio and solving, we obtain a diameter of 0.9 percent less. The wheels as designed and as built are exactly similar, except in so far as pitch has been altered by casting.

The efficiency of this wheel is

$$(1 - S_2) \times \frac{a\,S_2\,X_t - f\,Y_t}{a\,S_2\,X_t + f\,Z_t}$$

$$= 0.74 \times \frac{7.4 \times 0.26 \times 0.573 - 0.045 \times 0.787}{1.262}$$

$= 0.635$, or 63.5 percent.

Taking the power developed at 11.5 knots, the speed for which these ships were designed, and the wetted surface, displacement, etc., on run, we have the following from the *Pawnee*:

Speed corrected for tide = 11.5 knots.

Friction of engine, etc., = 13 percent = 123.11 horsepower.

947 — 123.11 = 823.89 brake horsepower.

Apparent slip, mean, was 12 percent; true slip, mean, 25 percent; wake factor, 18 percent.

$11.5 \times (1 - 0.18) = 9.43$ knots, or 955.26 feet per minute.

Now, $0.75\ PN = 955.26$, whence $PN = 1{,}273.6$. Revolutions per minute = 103.5 (average for 11 runs). Then $P = 12.3$ feet, and as $P = d$, $d = 12.3$ feet.

$$\left(\frac{PN}{1{,}000}\right)^3 = 2.0669.$$

From drawing $X_t = 0.573$; $Z_t = 3.55$; $Y_t = 0.787$; $a = 7.4$, and $f = 0.045$.

Solving for mean width ratio we have

$$w = \frac{U}{3 \times n \times \left(\frac{PN}{1{,}000}\right)^3 \times d^2 \times (a \times S_2 \times X_t + f\,Z_t),} \quad \text{or,}$$

$$w = \frac{823.89}{3 \times 4 \times 2.0669 \times 151.29 \times 1.22} = 0.177$$

$$\text{Efficiency} = (1 - S_2) \times \frac{a\,S_2\,X_t - f\,Y_t}{a\,S_2\,X_t + f\,Z_t}$$

Substituting, we have

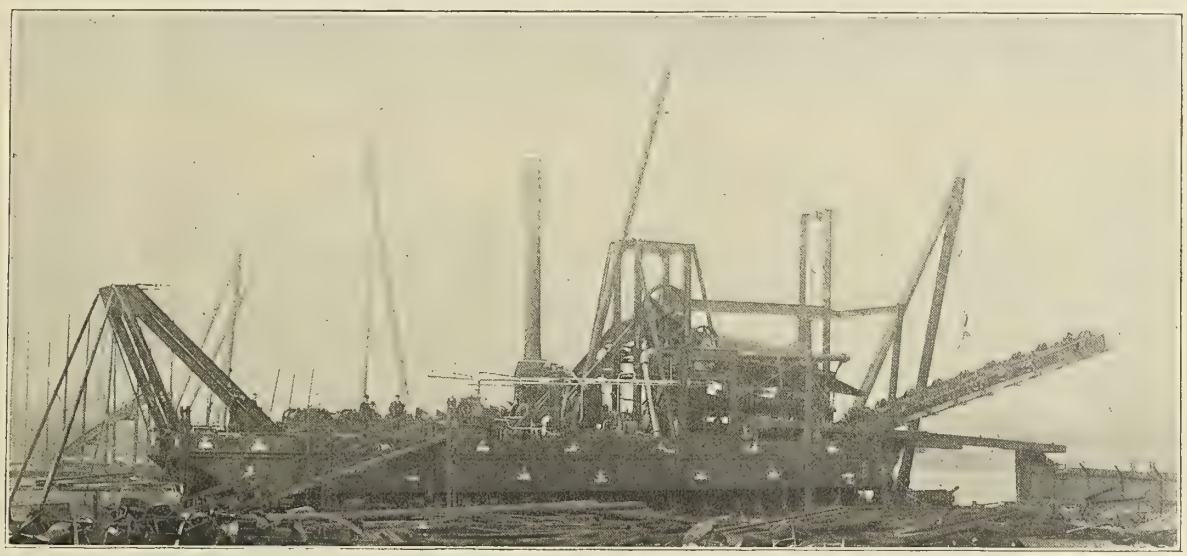
$$0.75 \times \frac{7.4 \times 0.25 \times 0.573 - 0.045 \times 0.787}{1.22} = 0.63, \text{ or } 63 \text{ percent.}$$

ACTUAL STEAM CONSUMPTION OF MAIN ENGINES.

Actual coal consumed per hour.	Pounds.
Per indicated horsepower	1.45
Per brake horsepower	1.67
Per effective horsepower	2.71
Steam consumption per indicated horsepower	16.54

The dryness factor was 0.985, by calorimeter. The evaporation from and at 212 degrees was 11.25 pounds, mean, for each pound of coal burned. These are mean values of each run for eleven runs; three of the *Pawnee* and eight of the *Delaware*.

The steam pressure was 170 pounds gage, 185 absolute; in intermediate receiver, 73.5 pounds, absolute; in low-pressure receiver, 24 pounds, absolute. The vacuum was 26 inches. The temperatures were as follows: Sea, 44 degrees; discharge, 110 degrees; feed-water leaving condenser, 127 degrees; feed-water in heater, 210 degrees; engine room, 86.5 degrees, and fire room, 92.5 degrees. These results are mean, and show actual sea conditions, or conditions obtained in free route. The fuel burned per hour per square foot of grate for average runs was 24 pounds, with 1¼ inches of air pressure. No smoke issued from the stack at any time.



DREDGER FOR ALLUVIAL TIN, FOR THE TONGKAH HARBOR TIN DREDGING COMPANY.

A Dredger for Alluvial Tin.

William Simons & Company, Limited, of Renfrew, have completed for the Tongkah Harbor Tin Dredging Company one of the largest and most powerful dredgers yet built, for working the alluvial tin deposits in the Straits Settlement. With the necessary modifications on the saving tables, the dredger could be equally well employed in gold recovery. The buckets, formed of cast steel backs and hard steel bodies, fitted with lips made of special quality of steel to wear well, are 7½ cubic feet in capacity, and of strong design. The bucket ladder is built in the most modern form of girder work, designed for dredging to a depth of 40 feet under water level. The upper and lower tumblers are of cast steel. The lower tumbler is in two pieces, working in special bearings of cast steel and chilled iron. The buckets discharge the

material into shoots lined with steel bars. From thence it is discharged into the screen, which is of the revolving type, with graduated perforations, and is driven by friction gear at the lower end.

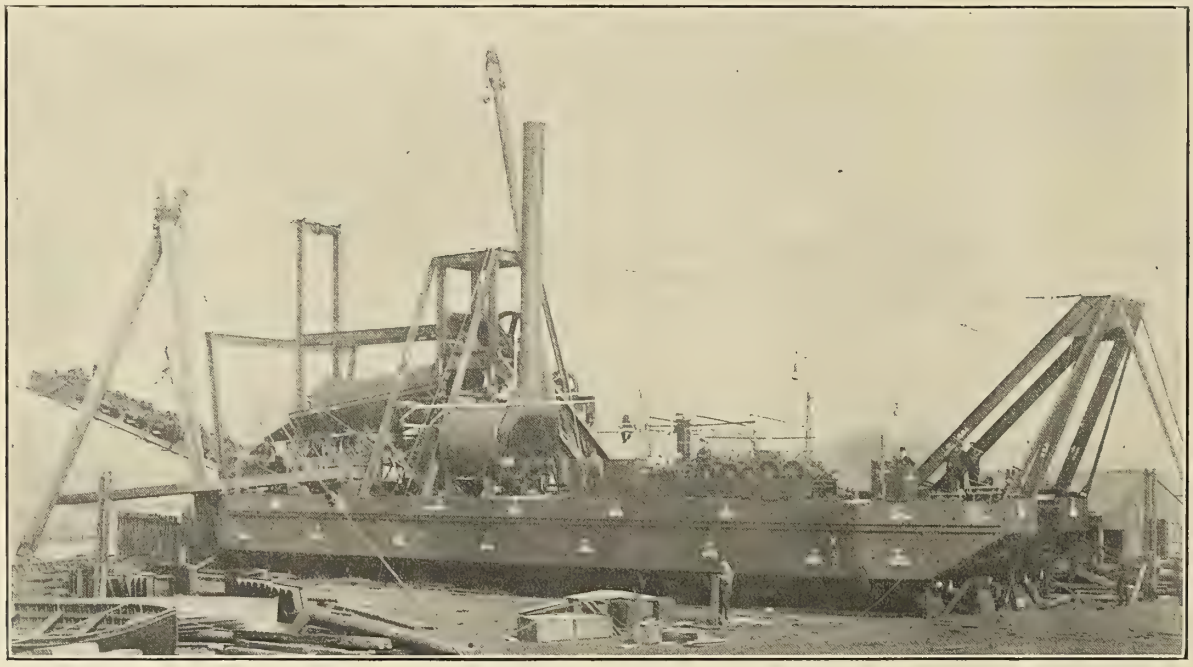
The dredging gear is driven from a set of horizontal compound condensing engines fitted with air and feed pump. Steam is supplied from a horizontal multitubular cylindrical steel boiler constructed for a working pressure of 140 pounds per square inch. Independent auxiliary steam feed and bilge pumps, with connections to tanks, water boat and bilges, are provided. Feed filter, meter and special vertical steam feed heater are also fitted up.

The dredging gear consists of spur gearing, with a large and powerful friction clutch, so that the buckets can be disconnected at will, while the screen and elevator gear are still running. The latter are driven from the first motion shaft of the dredging gear. Water is supplied to the screen by one 16-inch centrifugal pump, driven by vertical compound engines. The pipe from the water pump enters the screen at the lower end, and is perforated for its full length.

The saving tables are very large, and of an area suitable for the special material to be dealt with. In addition to the tables, special launders 60 feet in length are fitted on each side of the dredger. These launders are provided with riffles for their entire length, so that no paying material can be lost. The launders also serve the double purpose of carrying off the tailings from the tables sufficiently far astern so that even the softest material will not run back upon the buckets. The elevator is designed to discharge the material at a height of 20 feet, and to a distance of 50 feet from the stern. It is fitted with a close connected chain of buckets, each of which is a duplicate of each other, and they are interchangeable. The elevator drive is from the upper end.

A large and powerful mooring winch, driven by an independent two-cylinder high-speed engine, is placed on deck. It has six independent wire rope barrels; one for ladder hoist, one for head moorings and four for side moorings. All the barrels are arranged to work independently or conjointly. The dredger is electrically lighted throughout, and accommodation is provided on board for a crew. There are large tanks fitted up on board for feed water, and storage space for a large amount of wood fuel.

The hull is of steel, with wood decks, and is fitted with beltings at the waterline. It is of special strong construction to meet the various strains due to this class of work. All framing for carrying the gearing, bucket ladder, screen and tables is of steel built in single web section, to facilitate inspection and painting. A special feature of this vessel is that all working parts are carefully made to gage, and duplicate parts made from templates, so as to be entirely interchangeable.



TIN-RECOVERING DREDGER, BUILT BY WILLIAM SIMONS & COMPANY, LTD., RENFREW.

A NEW MINE LAYING STEAMER.

There has recently been constructed for the quartermaster's office of the United States War Department a twin screw steel steamer for harbor service in connection with the planting of submarine mines. This vessel has a length on deck of 86 feet, a beam molded of 20 feet, with a depth molded amidships of 10 feet 10 inches. The draft is 7 feet 3 inches, while the contract speed of 12.5 statute miles per hour was exceeded on trial, with a boiler pressure of 150 pounds per square inch.

BOW VIEW OF THE CAPT. A. M. WETHERILL.

THE MINE-LAYING STEAMER CAPT. A. M. WETHERILL. MOUNT BEACON IN BACKGROUND.

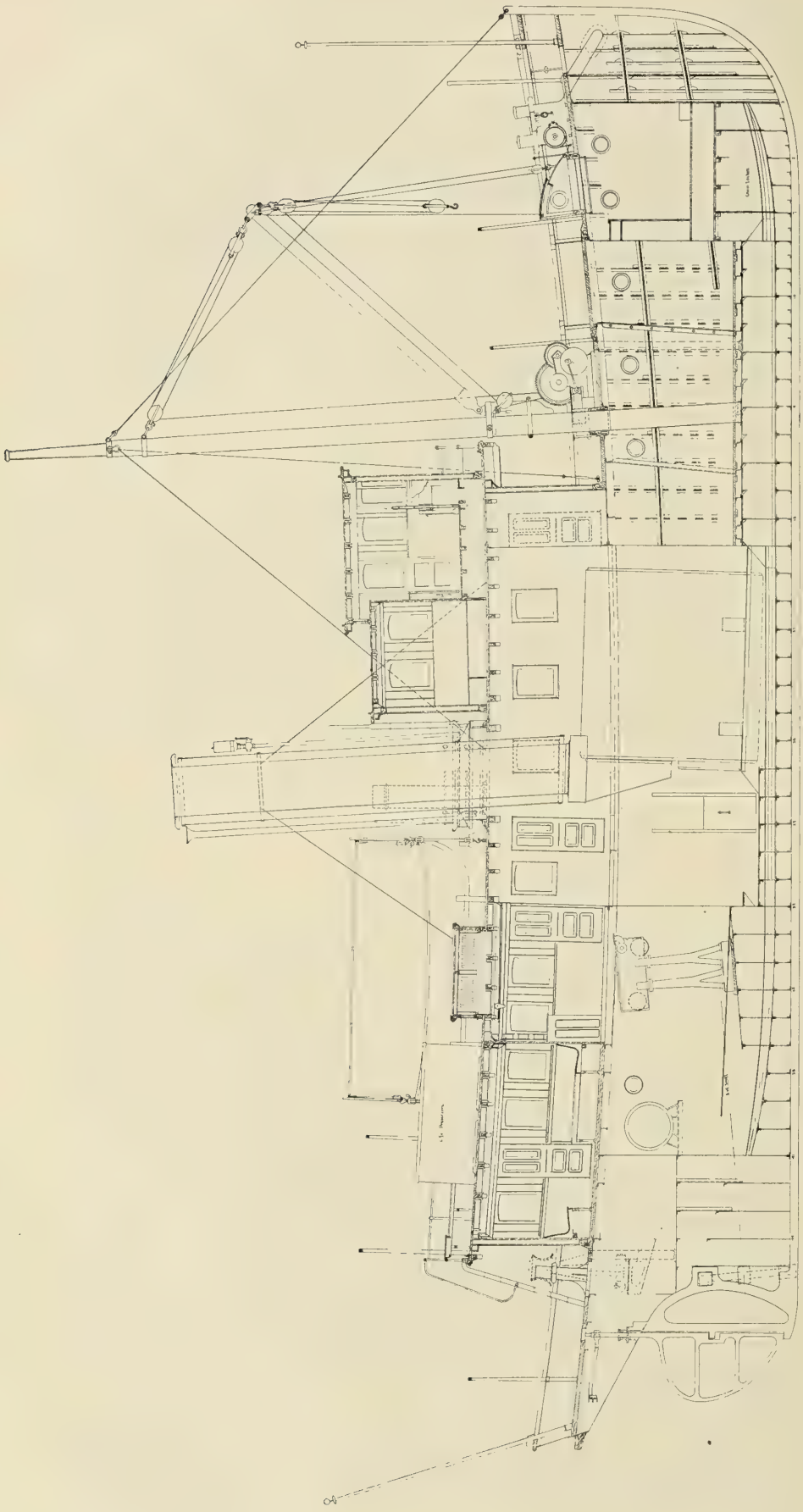
HULL.

The vessel has a bar keel with a tapering vertical plate keelson (12 pounds) extending from the after peak bulkhead to the forward collision bulkhead, and set in between double angles on top of floors, and double angles on the upper edge. The stem is a forging of refined bar iron measuring 6 by 1¼ inches. The stern is of forged steel, measuring 6 by 1½ inches, with counter and keel connections, eye for rudder post, bosses for rudder pintles, and lugs and seatings for palms of stern shaft bearing struts. The rudder post proper is 5½ by 2 inches, tapering to 1½ inches at the bottom.

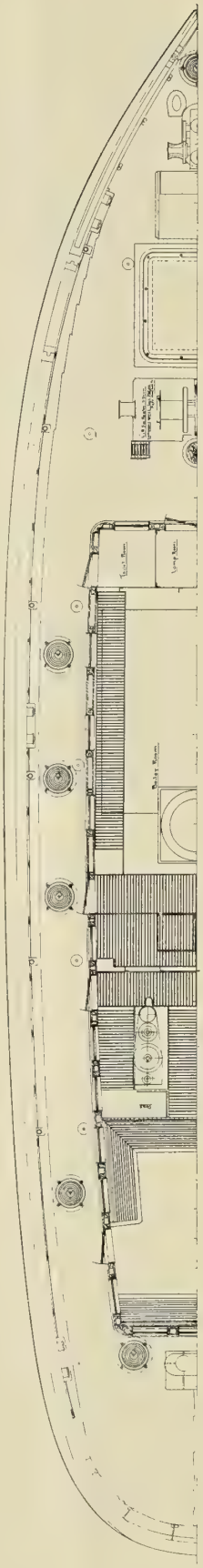
The transverse frames are 2½ by 2½ inches by 5 pounds, decreased to 2 by 2½ inches by 4.5 pounds at the ends, and are spaced 20 inches apart throughout the length. In the twelve forward frame spaces are fitted intermediate frames for additional stiffening. The frames are in one length from keel to deck, and are doubled at bulkheads. Reverse frames 2 by 2 inches by 3.2 pounds are fitted on every frame, and extend right across the ship. They reach alternately to deck and to upper stringer angles. The floor plates are 11 inches deep, fitted on every frame, and extend from the keel well up into the turn of the bilge. In the engine space they are extra deep, to form an engine foundation. Bilge stringers, formed of a pair of angles in long lengths, are located at the turn of the bilge, while upper stringers about at the waterline are similarly fitted. To carry the engines, keelsons and intercostals of 14-pound plate are erected from frame 32 to frame 39, with proper foundations for other machinery and auxiliaries.

The hull plating is shown in detail on the midship section. It consists in raised and sunken strakes, of which the garboard strake, 32 inches wide amidships, is next the frames. The sheer strake is 33 inches wide amidships. For precaution against ice, the plating at the waterline forward, for 16 feet

THE CAPT. A. M. WETHERILL IN THE HUDSON RIVER, OPPOSITE NEWBURG.



INBOARD PROFILE OF THE CAPT. A. M. WETHERILL, SHOWING GENERAL ARRANGEMENT, AND LOCATION OF MINE MAGAZINE.



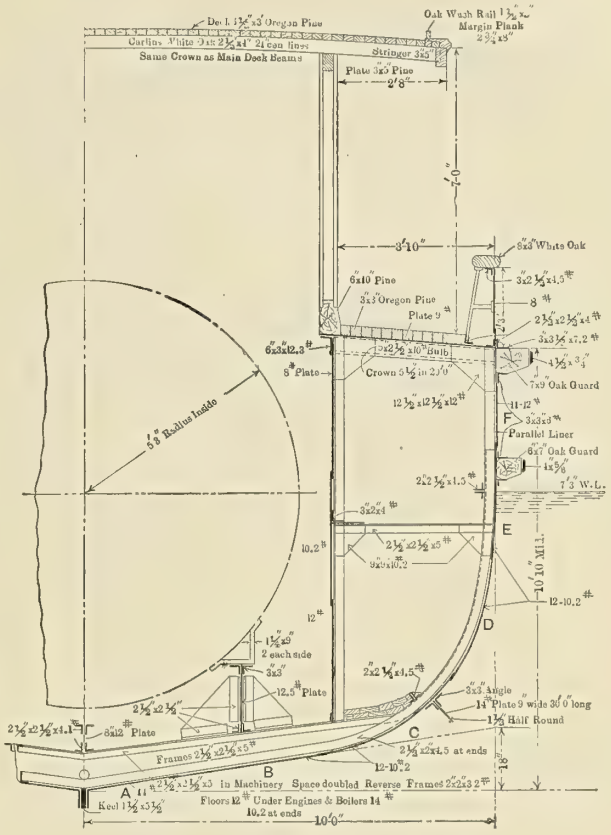
HALF PLAN OF THE MAIN DECK OF THE CAPT. A. M. WETHERILL, SHOWING HATCH TO MINE MAGAZINE, AND WINCH FOR HANDLING MINES.

in length, has been increased to 15 pounds per square foot.

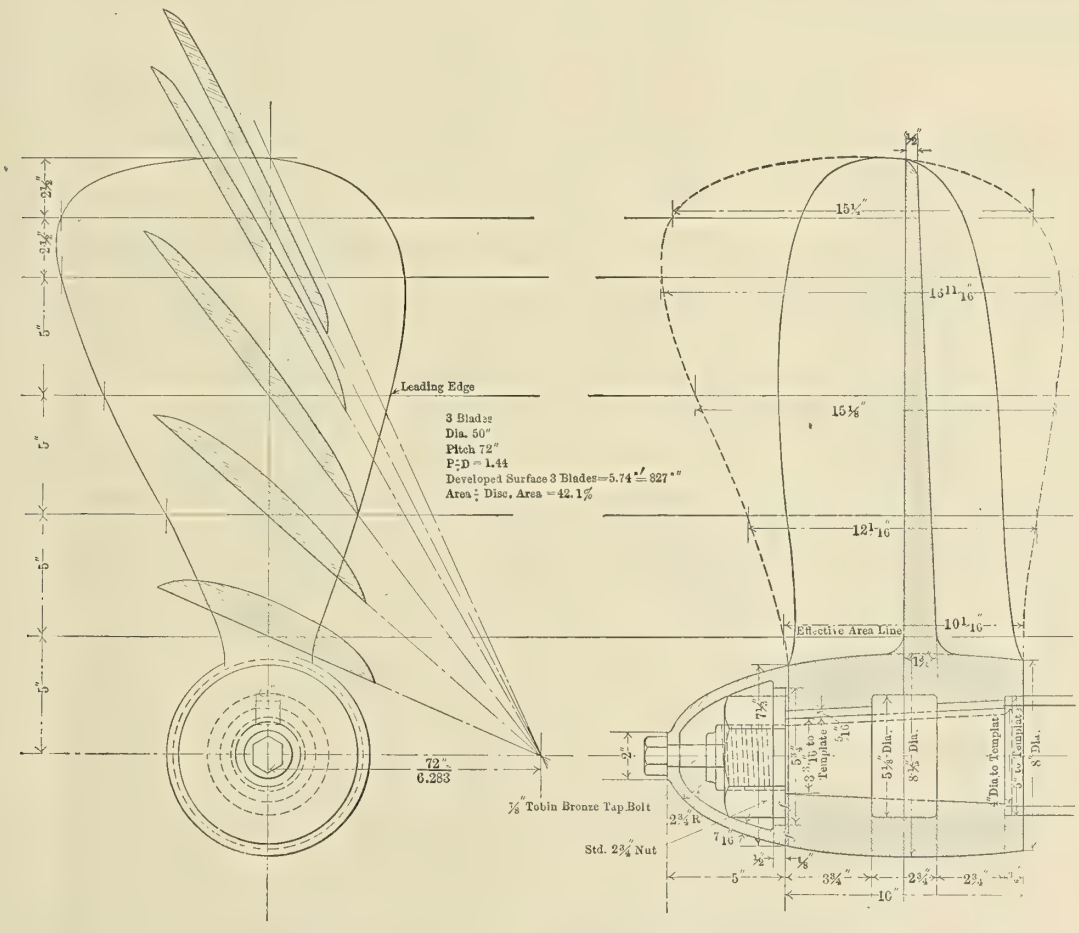
The beams on main deck are bulb angles, 5 by 2½ inches by 10 pounds, with intermediate beams, 3 by 3 inches by 7.2 pounds, where required. All beams have a crown of 5½ inches in 20 feet, while the ends are fitted with flanged brackets, as illustrated. Main deck stringer plates of 9-pound steel are worked along the outside ends of beams, while the entire deck at the bow and over the machinery space is plated with steel. Diagonal and other tie plates are fitted at various positions where needed.

There are three watertight bulkheads, located at frames 3, 19 and 41, all connected to outside plating by double angle bars (the transverse frames) and overhead to the deck beams. Two non-watertight bulkheads are fitted, at frames 8 and 30. In each case the bottom course of plating is 10 pounds; the intermediate, 9 pounds, and the top, 7 pounds. Vertical stiffeners, consisting of angles 2½ by 2½ inches by 5 pounds, are spaced 20 inches apart over the watertight bulkheads, and 24 inches over the others. Horizontal stiffeners of the same size, on the watertight bulkheads only, are 48 inches apart. The bunker bulkheads extend along the sides of boiler space, and are plated with 12, 10 and 8-pound steel. They are fitted with vertical stiffeners, 30 inches apart, consisting of angles 3 by 2½ inches by 5.5 pounds. The bottoms of bunkers are planked with Georgia pine 1½ inches thick.

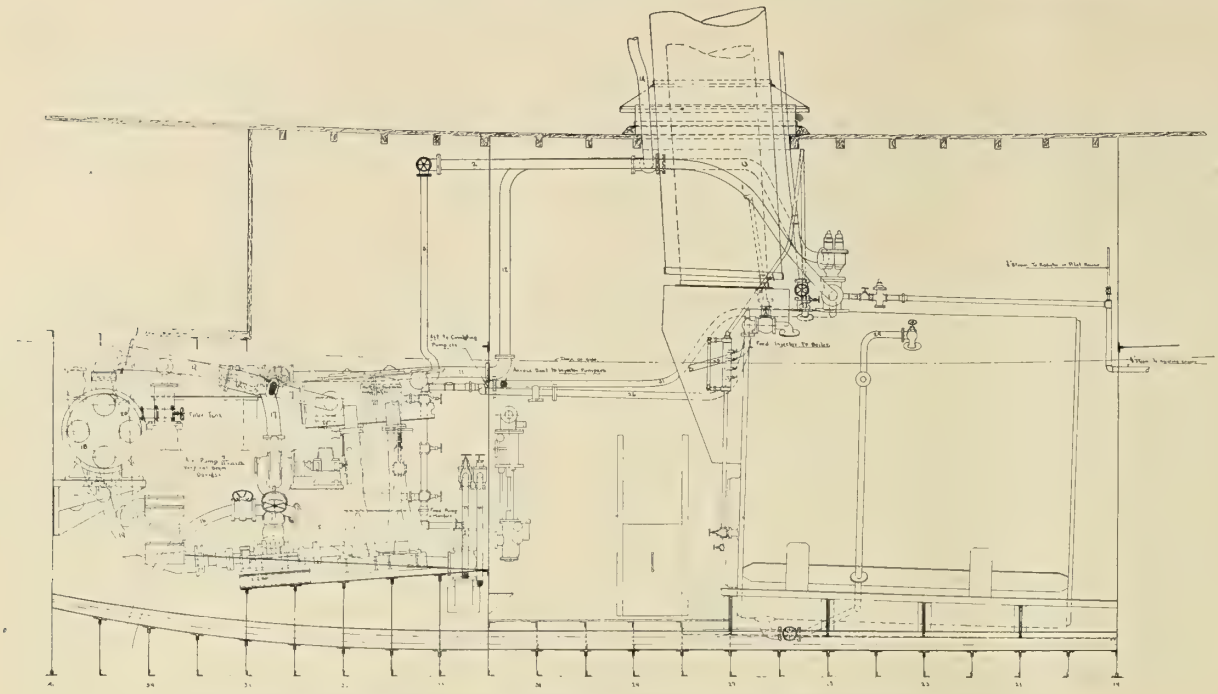
The main deckhouse is about 45 feet long, with the sides parallel to the sides of the vessel, and a passageway 3 feet 10 inches in width along each side. This deckhouse is constructed of wood, the sill coaming being of Georgia pine, struts and plates of pine, with upper deck beams of white oak. The clear height between decks is 6 feet 8 inches. The upper deck is of Oregon pine, 1½ by 3 inches, with margin plank 2¾ by 8 inches. The main deck is of Oregon pine, 3 by 3



MIDSHIP SECTION, SHOWING SCANTLINGS.



PROPELLER LAYOUT OF THE CAPT. A. M. WETHERILL, WITH DETAIL OF HUB AND CAP.

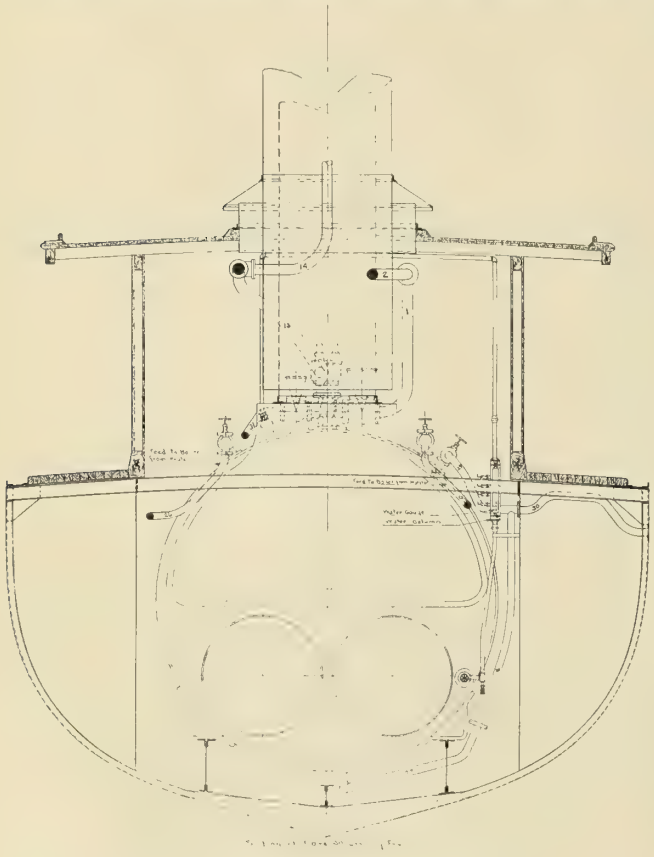


LONGITUDINAL SECTION THROUGH THE MACHINERY COMPARTMENTS, SHOWING PIPING LAYOUT.

inches. Tough oak fenders are carried, one of 7 by 9 inches being fitted at the main deck, while the other, 6 by 7 inches, is just above the waterline. Both are protected by steel plates. The pilot house and upper cabin measures 14 feet 6 inches long, 11 feet wide and 6 feet 6 inches head room.

MACHINERY.

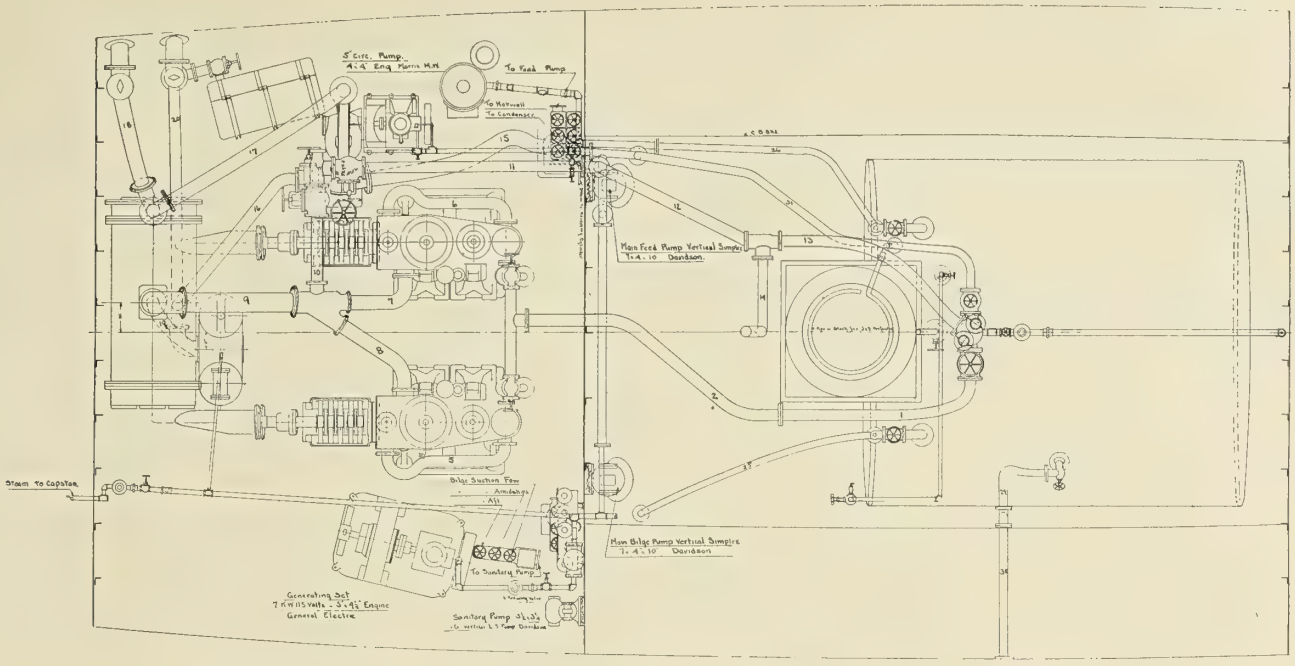
The vessel is propelled by twin screws, each of which is actuated by a compound surface condensing engine, both in the one compartment. Each engine has cylinders 7½ and 15 inches in diameter, with a stroke of 14 inches. The framing consists of cast iron inverted Y-pillars on the back side, and forgings of machinery steel for front columns. The crosshead guides are of the hollow bar type. The cylinders are of close grained cast iron, with barrels ⅞ inch thick. The castings include the valve chests, also heads, etc. The high-pressure cylinder is fitted with a piston valve, and the low-pressure with a double-ported balanced slide valve. These valves are operated by eccentrics and Stephenson link motion, the links being of the double bar type.



SECTION SHOWING BOILER AND SETTING.

The pistons are of cast steel, conical in shape, and fitted with hard cast iron packing rings. The followers are also of cast steel. The piston rods are of machine steel, 1½ inches in diameter. The stuffing boxes are fitted with metallic packing. The connecting rods are of machinery steel, 36 inches long between centers, and forked to span the crossheads. The crank shafts are of the built-up type, with cranks at 90 degrees. The main journals and crank pins are each 4 inches in diameter and 5 inches long. The crank webs are 2½ inches thick and 4¾ inches wide. The thrust and tail shafts are 4⅛ inches in diameter, and the former has five thrust collars. The thrust bearings are of cast iron, of the horseshoe type, fitted with anti-friction metal on both sides. The bearing surfaces are designed for a maximum pressure of not more than 40 pounds per square inch. The stern tubes are of cast steel, with stuffing boxes about 5 inches deep. The outboard ends have bushings 12 inches long, fitted with lignum vitæ.

The one boiler is of the Scotch type, 10 feet 6 inches inside diameter by 11 feet 6 inches long, and is fitted with two 40-inch Morison corrugated furnaces, 8 feet 9 inches long. The grate surface is 40 square feet, and heating surface 1,300 square feet, making a ratio of 32.5 to 1. The working pressure is 150 pounds per square inch. The tubes are of seamless cold drawn steel, 3 inches in diameter, 8 feet 6 inches long, and of No. 9 B. W. G. Heavy stay tubes of No. 6 B. W. G. are also used. The grates are in two lengths, the total being about 6 feet 5 inches. There is one smokestack of steel plate with double shell, the inside being of No. 10 and the outside of No. 12 B. W. G. The inside stack has a cross sectional area of



MACHINERY LAYOUT OF THE WETHERILL, SHOWING LOCATION OF AUXILIARIES, AND ALL PIPE LINES.

about 7 square feet. The entire stack measures 24 feet above the top of the boiler.

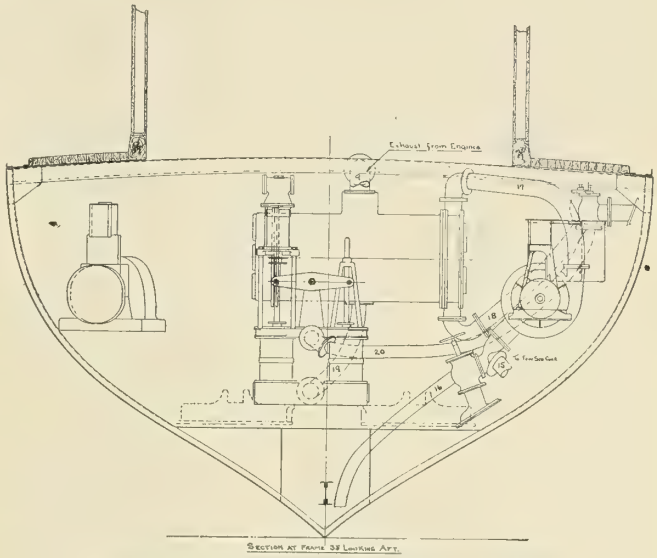
The main condenser has a cast-iron shell, and tubes of seamless drawn brass, No. 18 B. W. G., with about 400 square feet of cooling surface. There is a feed water heater discharging directly into the boiler, and designed for a maximum temperature of 220 degrees.

The feed pump measures 7 and 4 by 10 inches, and draws from the hot well, the forward feed tank, the trimming tanks, and sea injection valve; discharging to boiler, fire system and overboard. The bilge pump is of the same dimensions. The circulating pump is of the centrifugal type, driven by a direct connected engine with cylinder 4 by 4 inches and revolutions 150 per minute. The sanitary pump measures 3½ and 3¼ by 6 inches, and is designed for a discharge pressure not above 20 pounds. The main air pump was designed for a vacuum of 27 inches, and is of the vertical twin cylinder type, with one steam cylinder. One double tube injector and three steam siphons are fitted.

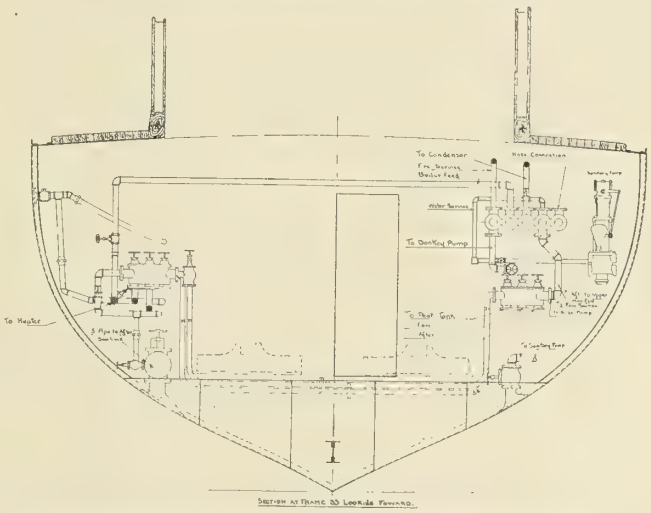
The windlass is of the tugboat style, with double bitts, one wildcat and one gipsy head. The chain pipes have a diameter of 6 inches. There is a steam capstan at the after end of deckhouse, for the rapid handling of tow lines for sub-caliber and service targets. This is driven by a double engine with cylinders 4 by 4 inches. A double drum steam winch, with double cylinder reversible link motion and double gipsy heads, is installed in connection with derrick gear at the foremast. It is designed for a load of five tons, and has a lever brake for quick lowering.

The propellers, of which we give illustrations, are three-bladed, solid, of cast steel, one being right handed and the other left handed. They have a diameter of 50 inches, a pitch of 72 inches, and a pitch ratio of 1.44. The developed surface is 5.74 square feet, which is 42.1 percent of the disk area. The outboard ends of the shafts are supported by cast steel struts, with bearings of cast composition 12 inches long, and fitted with lignum vitæ.

Electric lighting is provided by a 7-kilowatt General Electric (Schenectady, N. Y.) direct-connected set, all mounted on one bedplate. About fifty lights are provided for, as well as a 13-inch searchlight.



SECTION SHOWING CONDENSER, PUMPS AND DYNAMO.



SECTION SHOWING MANIFOLD VALVES ON ENGINE ROOM BULKHEAD.

Navigation by Celestial Observation, III.

BY STEPHEN P. M. TASKER.

LONGITUDE.

If we knew exactly when it was noon at our desired location, and knew from our chronometer when it was noon at Greenwich, the difference between the two times in hours multiplied by fifteen would be directly equal to the difference in longitude in degrees—1 hour accounts for 15 degrees. For the very reason that it is easy to get the latitude from a measure of the elevation of the sun at noon, because it is moving then so nearly parallel to the ground, it is impossible to get the exact time from an observation then. For a minute or so from noon the elevation does not perceptibly change; if we should measure an elevation then, and attempt to obtain time and longitude from it, the result would be very inaccurate, because an error of a minute would mean 15 miles in longitude. We therefore readily see that we cannot use for longitude any celestial body when it is on our meridian; but we can measure that same body both before and after noon in the case of the sun, and before and after its meridian passage in the case of a star. We then, by figures or tables, bring an observation taken (say) 3 hours before meridian passage up to what it should be if taken at meridian. At this time the elevation of the sun or star is changing very rapidly, and we can note a change of elevation for each second of time.

Remember that the right time to measure the sun is about 3 hours before noon, or 3 hours after noon. A greater time would bring in too much refraction, for which correction we cannot always depend on the tables when the body observed is at a low altitude (the density of atmosphere and temperature then counting for much), and less time makes the time inaccurate, due to the slowness with which the elevation of the body is changing. From horizon to meridian there is a decrease of speed, then an increase. Also, the nearer the body is east or west at about the correct hour for observation, the more accurate the result. If we find the sun at (say) 9 A. M. or 3 P. M. is too low in the southwest or southeast, we should ignore it, and find a star that bears nearly east or west 3 hours before or after it has crossed our meridian. The Nautical Almanac will tell this time for all the stars, and you can choose one you know; or, if you don't know any, with your star map you can find one.

When you are ready to take an observation for longitude, adjust the telescope and dark glasses as before, and have some one handy with the chronometer. Look through the sextant at the point of the horizon exactly below the sun or star, and move the arm until the lower edge of the sun or the center of the star lies in this horizon. Then clamp the arm and you will see the sun or star, as the case may be, very rapidly separate from or dip below the horizon, depending on A. M. or P. M. Bring the image a little above or below the horizon, and, clamping the arm of the sextant in this position, watch accurately until they move together. When contact is made, call out "take" to assistant, who will note exact time. You may note the sextant reading, and work the problem up later. If you take the average of three readings and three times, the result will be better. You can do this in longitude working, but not in latitude without more complicated calculation, which is not needed, and is out of place here. Remember, in all longitude observations you have a good margin of time to work on, 8 to 10 in the A. M., and 2 to 4 P. M., but in latitude, if you are not on hand exactly when sun or star crosses meridian, the observation of this body is lost for the day.

RULE.

To Find the Longitude by Observing the Sun.—Measure one or more altitudes, and record the corresponding times. Find the mean (or average) of the sextant readings, add or subtract the index correction and subtract the dip. Subtract the correction for parallax and refraction from Table 20 B, and add the sun's semi-diameter. The result is the true central altitude. (T. C. A.)

(2) Subtract the true central altitude from 90 degrees. The result is the zenith distance.

(3) Find the sun's declination (the book gives the declination for Greenwich noon. Add to this, or subtract, the "difference for 1 hour," multiplied by the number of hours after Greenwich noon; the result is the declination). Subtract the declination from the latitude, if the declination is north; add the declination to the latitude if the declination is south, the resulting angle is the angle *M*.

(4) Then form four angles as follows: Add *M* to the zenith distance and divide the sum by 2; this gives first angle. Subtract *M* from zenith distance and divide result by 2; this gives second angle. Subtract the latitude from 90 degrees; this gives third angle. Subtract the declination from 90 degrees; this gives the fourth angle.

(5) Add sine of first angle to sine of second angle; the sum is *R*. (Table No. 44). Add sine of third angle to sine of fourth angle; the sum is *S*. Add 20 to *R*, subtract *S* from the sum, and divide the remainder by 2. Then find the angle which has this quotient for its sine, multiply this angle by 2 and change to hours, minutes and seconds, by Table No. 7. This is the angle *A*.

(6) If the sun is west, the result is the local apparent time. If the sun is east, subtract the result from 12 hours, to get the local apparent time.

(7) Add or subtract the equation of time to the local apparent time; the result is the local mean time.

(8) Correct the recorded watch time by adding or subtracting watch error, and adding or subtracting the correction for rate. The result is the correct 75th meridian time.

(9) Find the difference between the 75th meridian time and the local mean time; multiply by 15 to reduce to degrees, minutes and seconds; the result is the longitude, east or west of the 75th meridian.

To clearly illustrate this rule we will now work out the longitude from the following observations, which were made near Fort Chimo, in Labrador, on the afternoon of Sept. 4, 1906:

	Deg.	Min.	Sec.
The angle read from the sextant was.....	28	29	50
The index error (to be subtracted) was.....		1	14
Corrected angle	28	28	36
Correction for dip, Table 13, corresponding to a height of 10 feet.....		3	7
	28	25	29
Correction for refraction and parallax, Table 20. B.....		1	37
Difference	28	23	52
Correction for semi-diameter		15	54
True altitude of sun's center (T. C. A.)....	28	39	46

We are now going to compute the exact local time at which the sun had this altitude. The difference between this and the 75th meridian time, multiplied by fifteen, will then be the desired longitude. We make this computation exactly according to the rule as follows:

	Deg.	Min.	Sec.
	90	0	0
T. C. A.....	28	39	46
Zenith distance	61	20	14

Sun's declination = declination from N. A. + hourly motion × number of hours since Greenwich noon =

	Deg.	Min.	Sec.
7° 26′ 1.3″ — 55.16″ × 7.5 hours =	7	19	8
Latitude =	58	8	0
Declination =	7	19	8
Angle M =	50	48	52

We next form the four angles:

	Deg.	Min.	Sec.
Zenith distance =	61	20	14
M =	50	48	52
Sum =	112	9	6
Difference =	10	31	22
½ sum = first angle =	56	4	33
½ difference = second angle =	5	15	41
Third angle = 90° — 58° 8′ =	31	52	
Fourth angle = 90° — 7° 19′ 8″ =	82	40	52

Next we look in Table 44 and find the sines:

Sine of first angle =	9.91896
Sine of second angle =	8.96233
Sum = R =	18.88129
Sine of third angle =	9.72259
Sine of fourth angle =	9.99644
Sum = S =	19.71903
20 + R =	38.88129
S =	19.71903
Difference =	19.16226
½ of difference	9.58113

The corresponding angle from Table 44 is 22 degrees 24 minutes 24 seconds.

Multiplying by 2 we find 44 degrees 48 minutes 48 seconds.

Dividing by 15, angle A = 2 hours 59 minutes 15 seconds.

Equation of time from N. A. to be subtracted, 54 seconds.

Difference = 2 hours 58 minutes 21 seconds.

This is now the exact *local* time when the observation was made. The recorded watch time, corrected for the known watch error and rate, that is, the correct 75th meridian time, was

	Hr.	Min.	Sec.
Corrected watch time =	2	31	28
Local time =	2	58	21
Difference =		26	53
15 × Difference =	6°	43′	15″

Since the local time was later than the 75th meridian time, the observer was east of the 75th meridian. His longitude from Greenwich was therefore 75° — 6° 43′ 15″ = 68° 16′ 45″ (Answer).

TO FIND LONGITUDE BY A STAR.

When a star is observed there is no correction for parallax or semi-diameter. A computation is first made exactly as described in the above rule, until angle A is found. We then proceed as follows:

Find the right ascension of the sun. (The book gives the right ascension for Greenwich noon. Add to this, or subtract, the "difference for one hour," multiplied by the number of hours after Greenwich noon. The result is the right ascension).

Subtract the right ascension of the sun from the right ascension of the star. The result is X.

If the star is in the east, subtract the angle A from X. If the star is in the west, add A to X. Add or subtract the equation of time to the result; this gives the local time.

Having computed the local time, the longitude is found exactly as in the case where the sun is observed.

EXAMPLE.

At the same station as in the preceding example the altitude of Arcturus was measured with the sextant. The reading was:

	Deg.	Min.	Sec.
	28	6	10
Index error.....		1	13
Difference	28	4	57
Correction for dip		3	7
	28	1	50
Refraction		1	49
True altitude	28	0	1

	Hr.	Min.	Sec.
From this altitude we next find A, by the preceding rule, to be	4	33	19
The right ascension of the sun from N. A. =	10	51	51
The right ascension of the star from N. A. =	14	11	22
The difference = X =	3	19	31

	Hr.	Min.	Sec.
The star was observed toward the west.			
We therefore add A to X and find $A + X$ =	7	52	50
Equation of time from N. A. (to be subtracted)			59
Local mean time =	7	51	51
The corrected watch time was	7	24	56
Difference =		26	55
15 × difference =	6°	43′	45″ =
longitude east from 75th meridian			

Therefore the longitude from Greenwich, as determined from this observation, was 75° — 6° 43′ 45″ = 68° 16′ 15″.

The difference between this result, and that which we found from the sun, corresponds to only about a quarter of a mile, at the latitude of Fort Chimo.

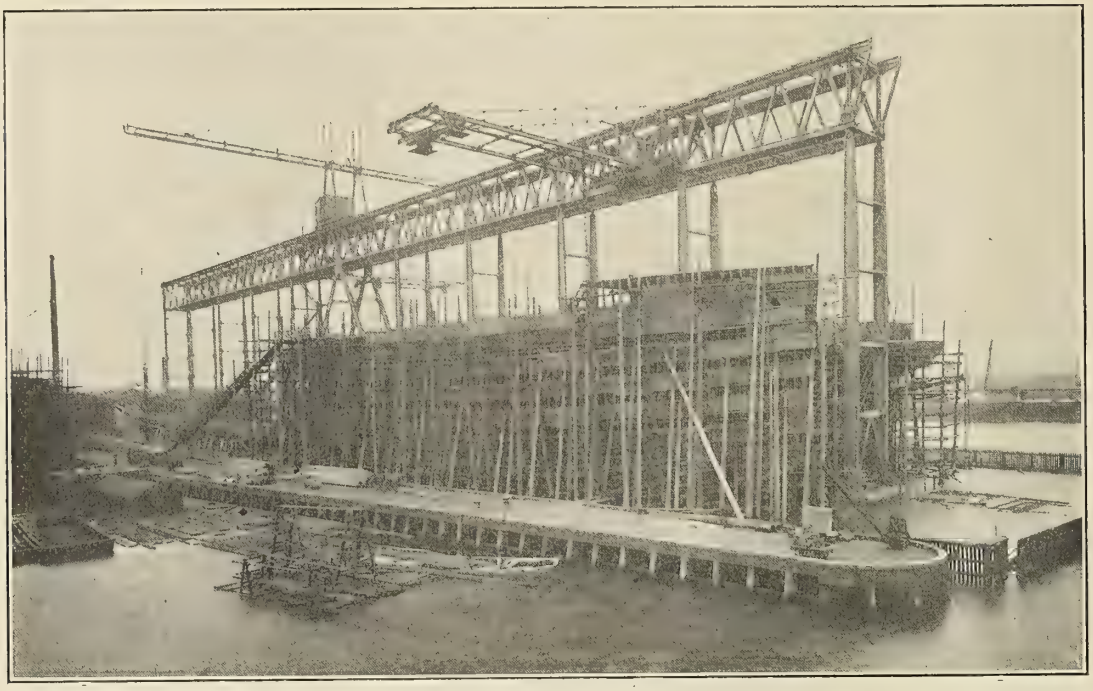
Wreck Statistics for 1906.

Lloyd's Register has published a summary showing the loss of vessels of all nations during 1906. The total amounted to 945 vessels aggregating 816,922 tons, not counting vessels of less than 100 tons. Of this total, 378 vessels of 509,707 tons were steamers, and 567 vessels of 307,215 tons were propelled by sail power. This figure may be compared with the average for five-year periods previously, as follows:

	Steamers,		Sailing Vessels,	
	Number.	Tons.	Number.	Tons.
1896-00.....	302	415,763	714	333,436
1901-05.....	324	458,977	534	275,735

The percentage of loss to total steam vessels owned has been decreasing for some time, as will be shown below:

	Steam,		Sail,	
	Number.	Tons.	Number.	Tons.
1896-00.....	2.06	2.12	5.17	4.70
1901-05.....	1.86	1.76	4.57	4.43
1906.....	1.94	1.68	5.58	5.40

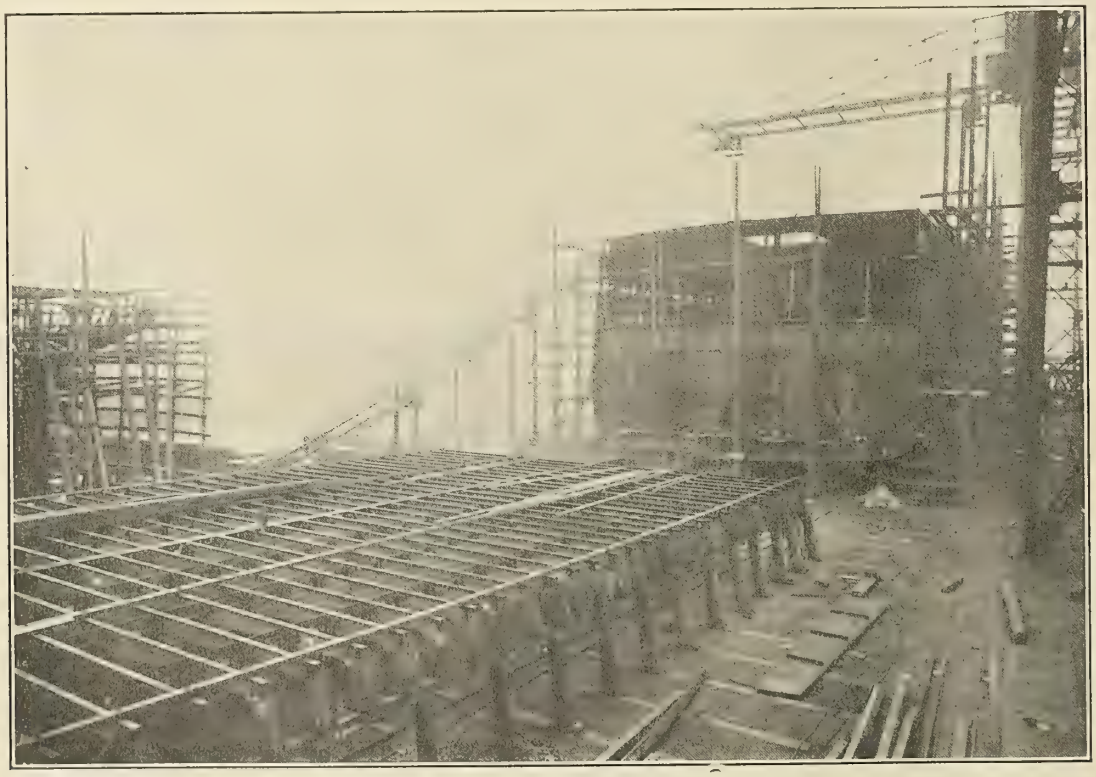


THE NEW FORE PART, HERE SHOWN PARTLY PLATED, WAS LAUNCHED BOW FIRST.

A New Fore Part for the Suevic.

It will be recalled that the White Star liner *Suevic,* which went aground last March off the Lizard, was cut in two and the stern rescued. A new fore part has been built by Harland & Wolff, Belfast, and was launched, bow first, Oct. 5, the launching weight having been about 3,000 tons. Our two photographs show this portion, the one taken from the water showing the bow pointing towards the water, and close alongside another vessel, of which the stern is visible. The other view shows the watertight bulkhead at the inner end of the new section, while in the foreground is seen framing for the double bottom of another steamer.

The length of the new part is about 183 feet, and when connected up with the stern at Southampton will give the total length as before of 550 feet. The operation of floating the structure required considerable care, but it was done successfully in every respect. The distribution of weights on board, which included two boilers, was such as to secure proper stability and trim. This bow portion contains the forward end of the deck houses and the captain's bridge. In the



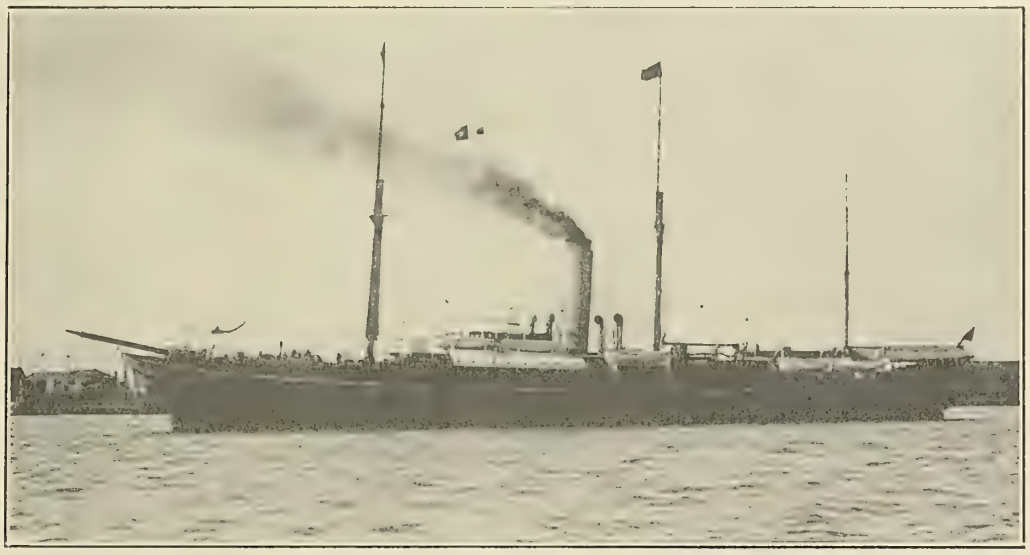
A WATERTIGHT BULKHEAD AT THE END OF THE NEW SECTION SERVED TO RENDER IT FLOATABLE.

meanwhile the salved portion of the ship has been placed in drydock at Southampton and sufficiently repaired to make it possible to connect up the new portion.

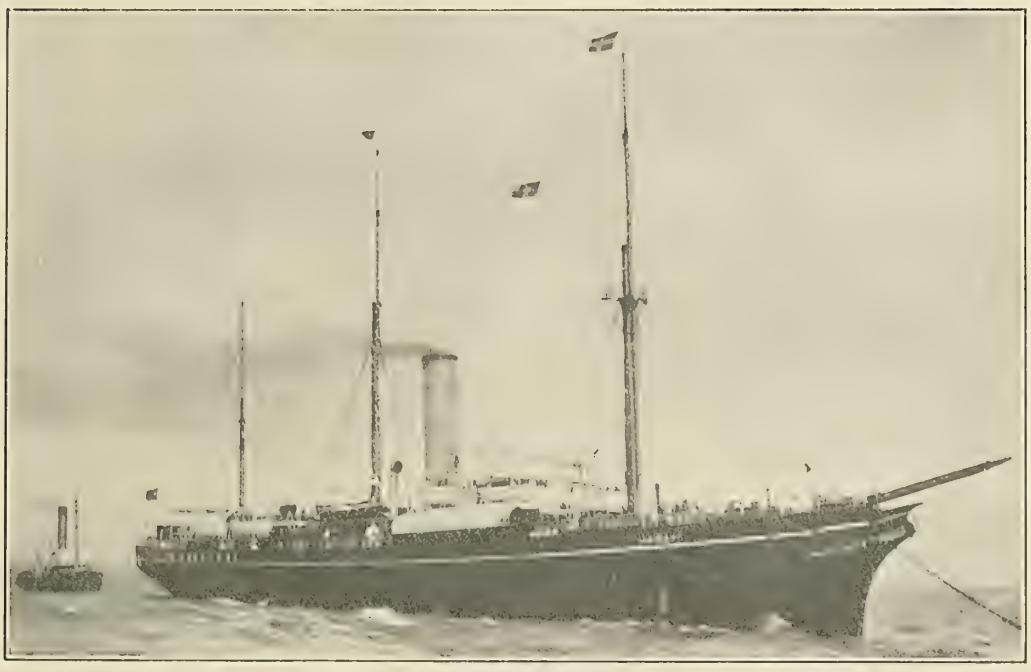
Preliminary connection was made Nov. 4, and the results were highly satisfactory. In order to insure stability, the tanks in the afterpart, and the boilers, were filled with water, and the stokehold and engine room were flooded. The sections seemed to connect with remarkable accuracy.

She left Hull Aug. 3 last with 150 first-class tourists, including about eighty ladies. Early on the morning of the 12th the yacht struck on the Molpolsa Varda rock in the Vilwaes fjord. The steamer had a list, in consequence of her position on the rocks, but the danger did not appear to be great. The boats were got ready, but as there was no pressing need they were not launched.

When the stranding occurred the Austrian yachting steamer



THE CRUISING PASSENGER STEAMER ARGONAUT.



PORT SIDE OF THE STEAMSHIP ARGONAUT.

Accident to the Argonaut.

The *Argonaut* is a handsomely fitted iron screw steamer, with clipper bow and three masts. She was built in 1879 by R. & H. Green, of London, and is of 3,274 tons gross and 1,967 net. Her dimensions are: Length, 332 feet 4 inches; beam, 40 feet 1 inch; depth, 32 feet 9 inches. She has had five different names—*Norse King, Orienta, La Plata, Norfolk* and now *Argonaut.* She is owned by the Co-operative Cruising Company, and is engaged during the summer months in making fortnightly cruises among the Norwegian fjords.

Meteor, which was in the vicinity, sent a boat to ask if any assistance was required. No help was needed, but the *Meteor* sent ashore at the first place she came to, and wired to Bergen for a tug to be sent out. This tug worked for two hours at the stranded *Argonaut,* but she refused to move, and the attempt had to be given up with the breaking of the tow line. Then a small steamer took off the passengers and their luggage, and conveyed them to Bergen.

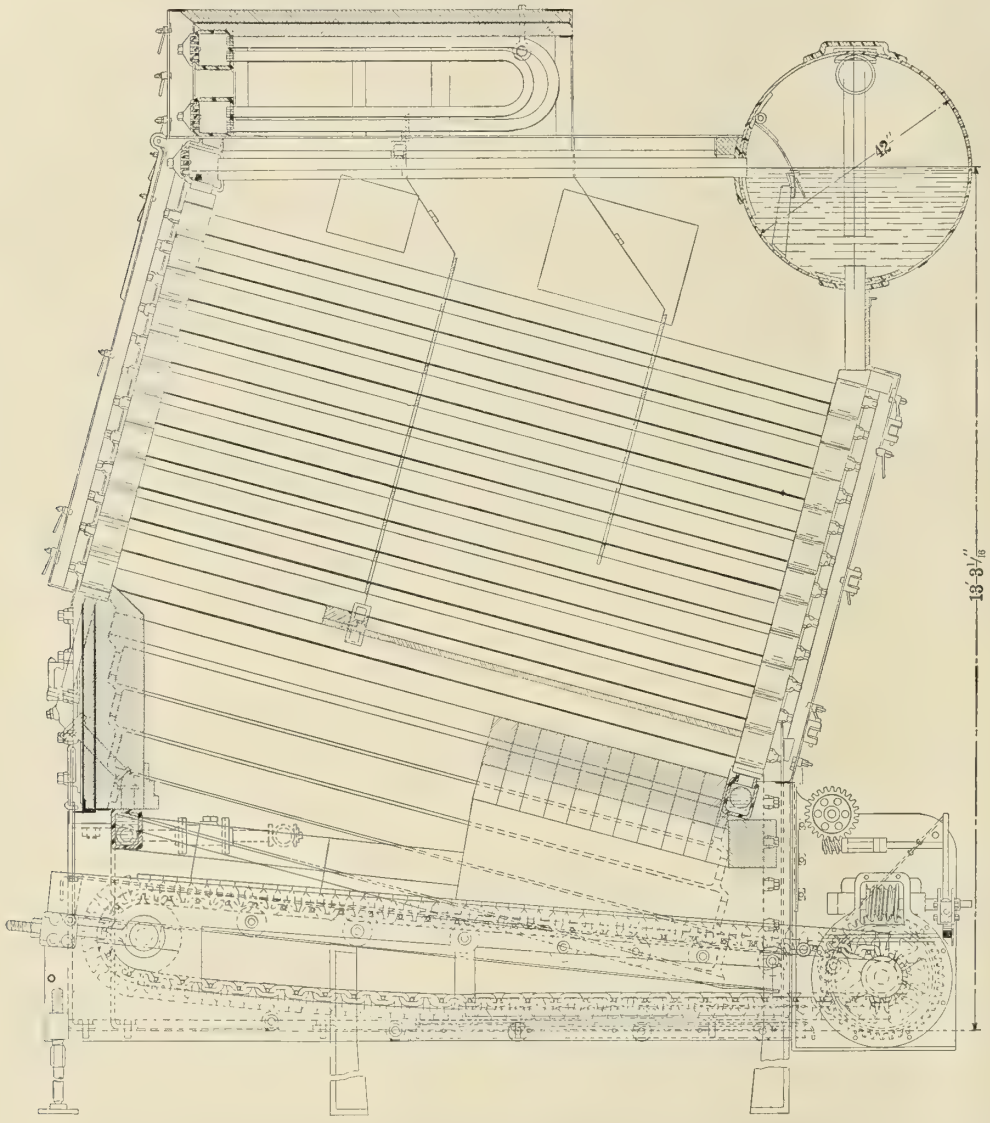
The vessel was eventually brought into Bergen, having been safely towed off the rock some 24 hours after the casualty.

Divers then ascertained that 35 feet of the keel had been torn off, but the vessel had made very little water. She left Bergen under her own steam and arrived in London for repairs, being ready for her Mediterranean cruise in September.

James Fisher.

were those made by a board of naval officers on the merchant steamer *J. C. Wallace,* on the Great Lakes.*

Superheaters are coming into use on various naval vessels of the different powers. The Dürr boiler in the German navy has for several years been fitted with a superheater. In England the battleship *Britannia* has been equipped with Babcock & Wilcox boilers, a portion of which are fitted with superheaters. It is understood that comparative trials of boilers with and without superheaters show an economy of about 10 percent in favor of the boilers with the superheaters. The first modern superheaters installed on vessels of the United States Navy are those fitted into a portion of the boilers of the battleship *Indiana.* Other vessels of late design are also to have their boilers fitted with these attachments.



BABCOCK & WILCOX BOILER ON JAMES C. WALLACE, FITTED WITH SUPERHEATER AND AUTOMATIC STOKER.

SUPERHEATED STEAM IN MARINE PRACTICE.

BY LIEUT. H. C. DINGER, U. S. N.

A very promising and seductive device for increasing the economy of the steam engine has been the use of superheated steam. Early attempts at using superheated steam in marine engines were made shortly after the steam engine came into use as a motor for propulsion. These early attempts, though resulting in economy, were afterwards abandoned on account of the complication, difficulty in keeping in efficient condition, and rapid decay of the superheaters on the one hand, and the trouble encountered in the valves and cylinders of the early engines, due to the high temperature and dryness of the steam, on the other.

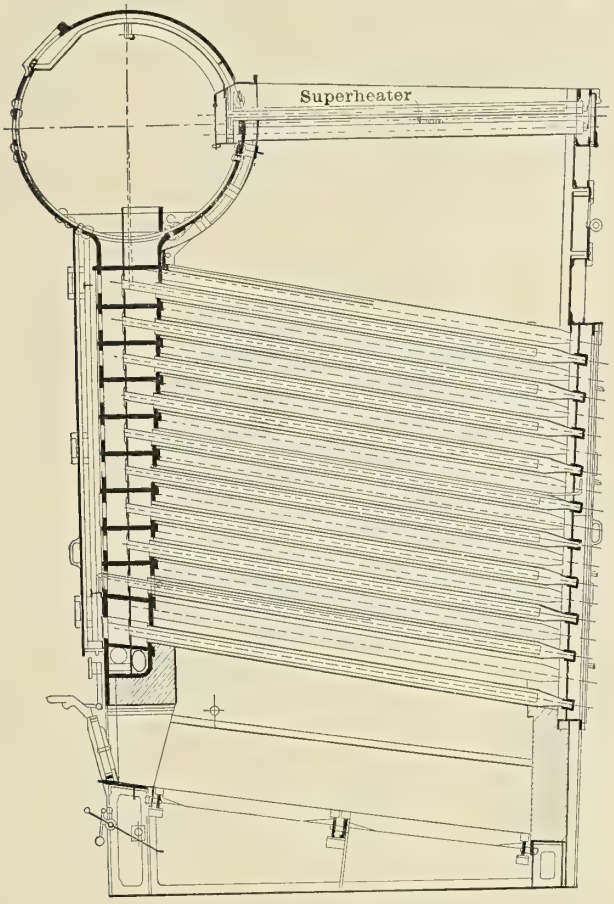
The use of superheated steam has of late years become quite common. It has thoroughly demonstrated its practical usefulness on land boilers, and also to a considerable extent on marine boilers. Some of the most interesting of recent tests

The details of the arrangement of superheater on marine boilers can be seen from the figure which shows the Babcock & Wilcox boiler on the merchant steamer *J. C. Wallace.* As arranged in this boiler, the superheater consists of two square boxes connected by U tubes. The steam, after leaving the steam drum, goes to one of these boxes, then through the superheating tubes to the other box, and then to the steam line. The gases strike the superheater after having passed

**Journal of the American Society of Naval Engineers,* August, 1905.

once through the tube nest, and by this arrangement are enabled to impart their heat in superheating the steam, while the temperature is considerably in excess of what it would be if the gases had completed their passage among the tubes, before they came into contact with the superheater.

In the Dürr boiler, the two rows of superheating tubes project from the steam drum, and the steam passes through them on its way from the steam drum to the steam pipe. In this



DUERR BOILER FITTED WITH SUPERHEATER.

case the gases strike the superheating surface after having completed their passage among the water tubes.

THEORETICAL POSSIBILITIES.

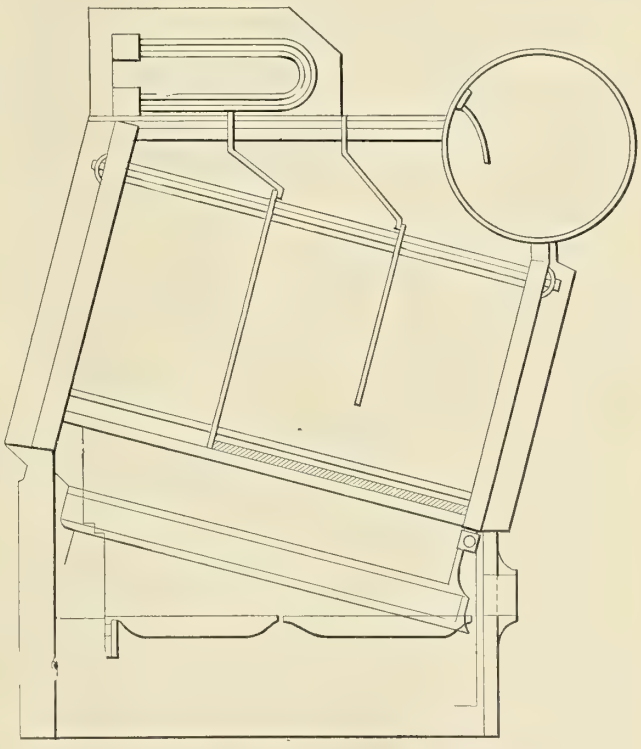
The economy due to superheating is secured by making a certain weight of steam carry with it more heat units than ordinary saturated steam contains. The amount of heat lost in engine and condenser being assumed to be the same, it naturally follows that a larger proportion of the total heat carried by a unit weight of steam is utilized when it is superheated than when only saturated. Thus, suppose a pound of saturated steam contains 1,200 British thermal units and that 1,040 British thermal units are lost in the condenser and engine. The efficiency of the steam in this case will be 160/1,206, or 13⅓ percent. Now, suppose the steam is superheated 100 degrees. It will then contain 1,270 British thermal units (assuming 0.7 to be the specific heat of superheated steam), and with 1,040 British thermal units lost in the condenser and engine, the efficiency of the steam will be 230/1,270, or 18.1 percent. The theoretical gain in this case would be about 36 percent.

This gain is, however, never approached in practice. Extra loss in radiation, and the probability that more heat is rejected, owing to incomplete expansion when superheated steam is used, bring the present practical limits of gain down to about 20 percent for 100 degrees of superheat. The theoretical condition is modified to a more or less extent by all the different things in which the actual engine differs from the ideal heat cycle. The great possible theoretical gain serves to show that there is a wide field for improvements that may be brought out to secure in practice a greater and greater percentage of this large possible theoretical increase in economy. It is most likely that, to obtain the full gain from the use of superheat, the number of expansions should be very great—much greater than has been the rule in marine engine practice.

PRACTICAL CONSIDERATIONS.

Superheated steam serves to lessen the losses due to initial condensation in the high-pressure cylinder. This condensation is quite a serious loss in engines using saturated or slightly moist steam. When superheated steam is used there is a cylinder full of dry steam to the point of cutoff, instead of having the same volume of partially condensed steam, with the attending drop in pressure below the expansion line and the waste due to this liquefaction. In this way superheated steam serves to perform an office similar to that of the steam jacket, but the superheat performs the duty in a much more efficient manner, since the extra heat is mixed up in the *whole* volume of the steam, while the heat of the jacket steam works only at the surfaces of the cylinders.

It has been conclusively proved by extensive practical experience that no bad results or difficulties in the way of cylinder lubrication are met with; nor has any inconvenience been



HAND-FIRED BABCOCK & WILCOX BOILER, WITH SUPERHEATER.

suffered from the handling of superheated steam in the engines, when built along the lines of modern approved practice, with hard cast iron cylinders and piston rings and piston valves for high and intermediate cylinders. The tightness of all steam joints is improved by having the steam superheated.

The gain in economy depends on the degree of superheat obtained. If the superheater gives but little superheat there may be some question as to whether the added weight and cost is worth while. To make it worth while, a superheater should give at least an average of 30 degrees of superheat.

With steam pressure at about 200 pounds above the atmosphere, a superheat of 35 degrees will give an increase in economy in coal consumption of about 5 percent; 70 degrees, 10 percent; 105 degrees, 15 percent. It is doubtful if much more than 100 degrees can be obtained in a practical marine installation, though on shore plants a superheat of over 200 degrees is sometimes obtained.

To obtain a high degree of superheat in marine boilers, some matters of special design must be introduced, as has been done in the superheating plants on shore. The superheating surface should be ample, and should be about 15 percent of the total heating surface. The total heating surface of the boiler can be about the same, or perhaps a little less than that used for a boiler not fitted with superheaters. The draft must be good, and good coal should be used, in order that a bright hot fire may be obtained. The presence of specially arranged brickwork for creating a high furnace temperature and avoiding smoke will add materially to the degree of superheat obtained. The distance of the superheating surface from the point of combustion should not be too great, neither should the intervening water tubes be spaced so closely that the temperature of the gases is reduced too much before reaching the superheater.

While the superheating surface should not be too far from the fire, it should, at the same time, not be so near to the fire that there is danger of burning out the tubes. It would seem that the superheater should be placed in a position in the boiler so that the gases, on striking the superheating surface, should have a temperature of about 1,200 degrees. This should produce a good degree of superheat, and at the same time avoid overheating the tubes of superheater.

An inrush of a great amount of cold air will reduce the furnace temperature. It is, therefore, possible that air heating arrangements will result in a practical gain in economy, on boilers fitted with superheaters. Elaborate air heating arrangements are, however, objectionable on the score of weight, and, in naval work, on account of additional room that they may require.

The degree of superheat obtained depends to a very great extent on the character of the firing. The fire should be even, thin, level and bright. These ideal conditions can be obtained more readily with moderate rates of combustion, good natural draft or moderate forced draft, and with good, systematic hand firing or mechanical stokers. With unsystematic hand firing, indifferent draft or under conditions where the output of the boilers is subjected to great variations, the degree of superheat will be lessened; as it will also be under the hurry conditions, and the erratic and somewhat careless firing, usually accompanying heavy forced draft.

With mechanical stokers, the inrush of cold air through the furnace doors, and consequent cooling of the furnace and the gases, is avoided. There is less smoke, and a hotter furnace is obtained; the temperature also is kept more uniform. All of these conditions tend to secure a higher degree of superheat. It is not unlikely that the general introduction of superheating in marine engineering will be followed by the introduction of the mechanical stoker. The superheater does not require the stoker to make it a success, but the advantages of the stoker will show with increased force where superheated steam is used.

On some boilers the presence of the superheater checks the draft slightly, and also aids somewhat the collection of soot, thus causing the boilers with superheaters to become dirty more readily than those without. This defect can be avoided by a better arrangement of the superheating tubes and by providing good facilities for cleaning them.

The small amount of extra gear added to the installation, the increase in weight and addition in expense, caused by the superheater, are very slight, and have no material bearing. A boiler with a superheater, in practice, requires no more attention than one without the superheater. There is no need of any special arrangement in the piping, the engine or the auxiliaries, when superheated steam is used. No change need be made in anything. Working with superheated steam really gives much less trouble, since there is less cylinder condensation and less leakage at joints, stuffing boxes and rods. Steam pipes and cylinders are kept in a drier state, and hence are less liable to corrosion.

There seems to be an impression that the use of superheated steam calls for a lot of changes and special arrangements. This is an error. Superheated steam can be used in any marine installation that is successfully using saturated steam, and the only difference noticed will be a reduction in coal consumption, much less leakage in joints and the absence of priming or water hammer. Superheated steam will give no cause of worry to the operating force, and needs no special attention.

GENERAL OBSERVATIONS.

Judging from the results that have been obtained in various marine installations where superheaters have been fitted, the following points have been demonstrated:

Superheaters are a practical device for gaining a very substantial increase in economy. The use of superheated steam is attended with no difficulty in well-designed engines. Superheaters will have a reasonably long period of life, and require very little care to keep them in efficient condition.

Mechanical stokers, in avoiding the admission of cold air through the furnace doors, and keeping an even, level and hot fire, will materially improve the degree of superheat obtained. Air heating arrangements, especially for the air that is introduced above the furnaces, should improve the superheat. The superheating surface should be arranged so that it will be subjected to a temperature of 1,000 to 1,200 degrees Fahrenheit. Fitting boilers with arrangements of fire-brick baffles, walls, etc., to add to the furnace temperature, will add to the degree of superheat. Poor coal and irregular firing, or heavy and smoky fires, will result in low superheat.

It is quite probable that the next practical and widely applied method of gaining increased economy in marine machinery, both naval and merchant practice, will be the general fitting of watertube boilers with superheaters and mechanical stokers. The superheater can be used, whether the engine is a turbine or a reciprocating engine, and with both coal and oil fuel.

Editor's Note.—The steam plant of the *Britannia* includes three cylindrical boilers and eighteen Babcock & Wilcox watertube boilers. All of the boilers are worked under forced draft on the closed stokehold system, and six of the eighteen watertube boilers are fitted with superheaters. The ordinary tube-heating area in these boilers was reduced by an amount corresponding exactly to the surface of the superheater, so that the total surface is the same. The six boilers were sufficient to drive the vessel at her cruising speed, the engines developing one-fifth of the total power. As at this stage the coal consumption is heaviest per unit of power, owing to the large water consumption of the main engines when developing so low a proportion of their full power, and to the fact that the auxiliary water consumption then bears such a large proportion to the total, the improved economy is important. It was decided to run a thirty hours' trial with saturated steam, using six of the ordinary watertube boilers, and, for comparison, a trial of corresponding duration with superheated steam, the six superheater boilers being used. As the cutoff and other conditions of working the engine were identical, the only variant was the temperature of the steam. On this trial it was found that the superheated steam gave 111 horsepower less, which would indicate that if the whole of the steam plant is to be

worked under the superheater system, a greater capacity of cylinder may be desirable, or an alteration made in the cutoff. The economy, however, of the superheated steam was pronounced, as the coal consumption with saturated steam was 2.07 pounds per indicated horsepower per hour, against 1.77 pounds with superheated steam, while the water consumption was 21.02 pounds per indicated horsepower, as compared with 18.9 pounds for superheated steam. The amount of superheating at the boilers was 92.5 degrees Fahr., and at the engines 83 degrees above that due to the steam pressure. The water evaporated per pound of coal was slightly higher in the case of the superheater trial, and the uptake temperature was slightly lower, being 347 degrees on the superheated steam trial, as compared with 398 degrees on saturated steam.

The Damage to the Bavarian.

The Allan Line steamer *Bavarian,* running between Montreal and Glasgow, struck on Wye Rock, fifty-eight miles from Quebec, on the night of Nov. 3, 1905. After many attempts had been made to refloat the vessel, all without success, she was taken in charge, largely as a speculation, by two young American engineers, and refloated by a novel use of compressed air. This work was begun in September of 1906, and the ship floated in November of the same year.

In order to render the interior of the vessel sufficiently strong to withstand the forces which were to be brought to bear upon her, it was necessary to reinforce the decks with a large amount of timber bracing. This was done in the 'tween decks, and all the hatchways leading below into the holds were sealed watertight. The position of the vessel on the rock was such that the entire bottom was broken for a distance of about one-half the total length, and located almost amidships. As a result, all of the compartments near the middle of the vessel were flooded, and, when air under a heavy pressure was introduced into these various compartments, the water was driven out to make way for it in sufficient volume to permit the vessel to float.

THE ALLAN LINE STEAMSHIP BAVARIAN AT INDIAN COVE, AFTER BREAKING IN TWO.

Unfortunately, the breaks in the bottom were of such an extent that, after the vessel was finally floated and towed to Indian Cove, near Quebec, she broke in two amidships on Sept. 28, 1907, just forward of the boilers. She still remained afloat, however, and the break was temporarily patched by means of tarpaulins. It is announced that the wreck will be sold at auction.

The vessel was built in 1899 by William Denny & Brothers, at Dumbarton, and was a twin screw steel steamer rigged as a schooner. The length is 501 feet (520 feet over all), with a beam of 59 feet 3 inches and a depth of 39 feet 8 inches. The double bottom was constructed for water ballast. The net and gross tonnages were respectively 6,714 and 10,387. Propulsion was by means of two triple expansion engines, with cylinders 29, 47 and 77 inches in diameter, and a stroke of 54 inches. She saw service in the South African war, being used as a transport by the British government.

The Dreadnought.

Schiffbau is authority for the following resumé of the construction and other weights on the British battleship *Dreadnought*:

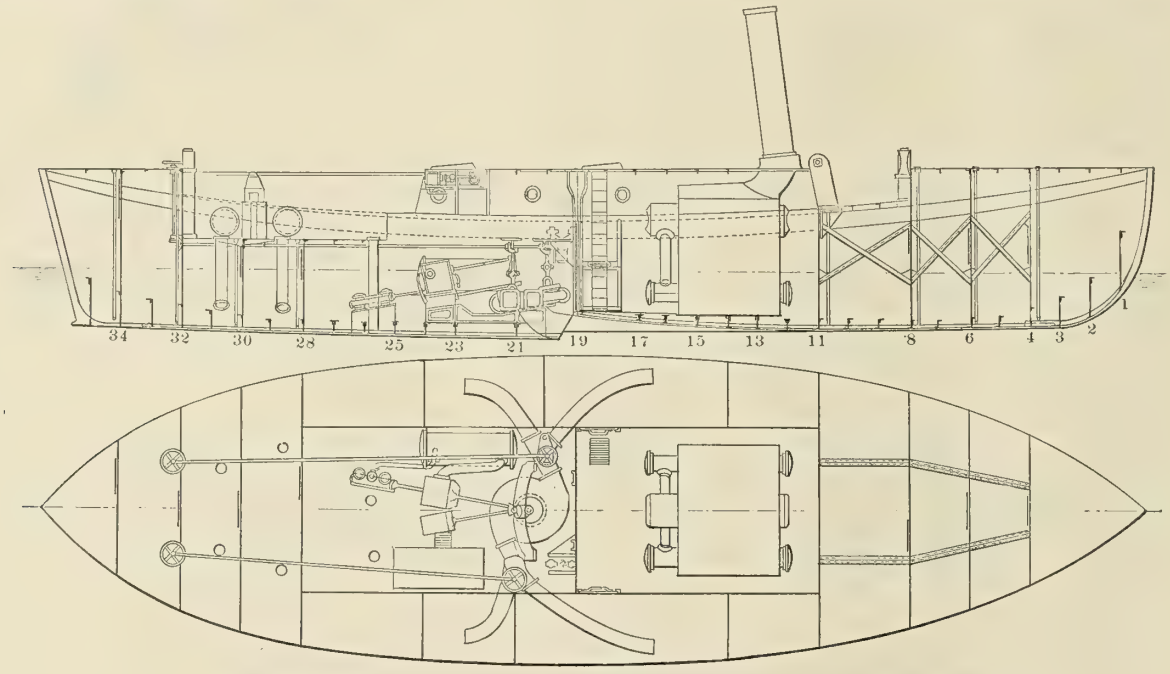
	Tons.	Percent.
Hull	5,930	33
Vertical armor	3,725	20.85
Protective deck	1,025	5.73
Splinter armor	375	2.09
Machinery	1,870	10.44
Auxiliary machinery	320	1.75
Fuel	900	5.02
Battery and ammunition	2,850	15.92
Torpedo outfit	80	0.44
Equipment and stores	825	4.76

The machinery outfit at 1,870 tons has given a splendid result in the development of power for each ton of weight. The trial trip showed an average of 24,700 developed horsepower, which for comparative purposes may be considered equivalent to 27,000 indicated horsepower. This makes 13.21 developed horsepower and 14.44 indicated horsepower for each ton allotted to the propelling outfit as a whole. It is not made clear, however, whether the figures for auxiliary machinery should be here included, in order to make up the total figure usually comprehended under the heading of steam engineering, as distinguished from deck and other auxiliary machinery. If this is to be added, we have a total of 2,190 tons, which gives only 11.27 developed horsepower and 12.32 indicated horsepower per ton. The difference, it is needless to say, is quite marked.

Professor William F. M. Goss has just accepted the position of dean in the College of Engineering of the University of Illinois, his special work to be identified with the new school of Railroad Engineering and Administration. Professor Goss is

recognized as a very high authority in the particular field to which he is to devote his attention, having for many years been the head of the mechanical engineering department of Purdue University.

Richard D. Hurley, manager of the Pittsburg (Pa.) office of the Independent Pneumatic Tool Company, died in Chicago, Nov. 5, of heart disease. He was 39 years old, and had been in the pneumatic tool business for ten years.



INBOARD PROFILE AND MACHINERY ARRANGEMENT OF THE LIFEBOAT PRESIDENT VAN HEEL.

A Hydraulic Propelled Steam Lifeboat.

It is worthy of mention that the lifeboat which rendered such signal service in connection with the disastrous wreck of the *Berlin*, at the Hook of Holland, has seen perhaps as much arduous service in the twelve years since it was delivered by Messrs. John I. Thornycroft & Co., Ltd., of Chiswick, as any such boat now in existence. The *President Van Heel*, as this vessel is named, was the first boat of the actual lifeboat class to be hydraulically propelled by machinery pumping two jets of water from tubes arranged astern.

It was fitted with Thornycroft boiler and machinery of a special type to meet the exceptional conditions which prevail under circumstances such as the late disaster, and the advantage of such a boat cannot be questioned, when it is borne in mind that the rescues it was able to effect would have been absolutely impossible with a lifeboat using oars only, or by any other class of steam-propelled boats.

The dimensions of the boat in question, which is built entirely of steel, are—length over all, 55 feet; on the waterline, 53 feet; breadths, molded, 13 feet 6 inches; over sponsons, 15 feet; and extreme, 16 feet, the molded depth being 5 feet 6 inches. She has an extreme draft, when fully loaded, of 3 feet 3 inches; the load consisting of crew, 4 tons of coal, mast and sails, some thirty or more passengers, and her tanks full of fresh water, which, with the propelling machinery and boiler, give her a displacement of about 30 tons. The hull is divided into eighteen watertight compartments, two of which are occupied by the engines and boiler, and two forming the coal bunkers, each being capable of being freed of water—the smaller by means of a portable deck pump, and the larger by the main engines.

The propelling machinery consists of a compound surface condensing engine, driving direct a nearly horizontal centrifugal pump, the impeller of which, 30 inches in diameter, delivers the water with which the pump is fed, by a scoop-shaped inlet amidships, through four nozzles or outlets in the sides of the boat, two for motion ahead—one on either side—being placed below the water aft, and those for motion astern close under the sponsons above water, forward. The engine is nearly horizontal, the cylinders being side by side and inclined. The diameters of the cylinders are 8½ and 14½ inches by 12 inches stroke. The engine has no reversing gear, but is always running one way, the direction of the boat ahead or astern being controlled by valves in the discharge pipes from the centrifugal pump. These controlling valves can be worked either from the engine room or by the coxswain at the steering wheel, and by moving one valve only the boat may be made to turn around on her center, and may consequently be steered independently of the rudder. The boiler for supplying the engines with steam is of the Thornycroft water-tube type, and is capable of supplying ample steam at a pressure of 145 pounds per square inch to enable the engines to develop about 250 indicated horsepower.

The boat is steered by an ordinary deep rudder, which is moved by simple worm gearing and fitted with an arrangement for tricing it up in shoal water, without interfering with steering operations. For working the anchor and warping purposes a steam capstan, driven by an independent engine, is fitted at the after end of the engine room, a reel of 100 fathoms of flexible steel wire rope being fixed in the cockpit or well of the boat. To assist the propelling power and the steadying of the boat it is fitted with a mast hinged in a tabernacle forward, which, when not in use, is lowered and stowed along the covering of the machinery. When in use it carries a lug sail and staysail.

The mean speed attained over six runs on the measured mile was 9.294 knots, or fully three-quarters of a knot in excess of that guaranteed by the builders, which was 8½ knots in the fully-loaded condition. This speed was attained with a steam pressure in the boiler of 140 pounds per square inch, maintained with an air pressure in the stokehold equal to 2⅜ inches of water, the indicated horsepower developed by

THE THORNYCROFT-BUILT DUTCH LIFEBOAT PRESIDENT VAN HEEL.

the engines, which were running at a mean of 449 revolutions per minute, being about 220. After the speed trials the lifeboat was tested in turning evolutions with and without the use of the rudder, and it was especially remarked how easily she was put about or her head put in the desired direction, quite independently of that directing instrument.

A Peculiar Accident.

The United States torpedo destroyer *Lawrence* recently met with an accident that recalls Lewis Carrol's line:

"Then the bowsprit got mixed with the rudder sometimes."

In this case, however, the rudder got mixed with the port propeller, as may be seen from the photograph taken after the vessel had been placed in dry-dock. While the boat was maneuvering with both engines backing at half speed, the helm being over about 10 degrees to starboard, a turnbuckle in the steering transmission broke. The rudder, released in this manner, swung freely, gaining sufficient momentum to carry away the rudder-chock; and then, as there was nothing to prevent, it fouled the propeller. The rudder was cut half in two and the port engine stopped. The destroyer, being unmanageable, had to be towed in. Needless to say, one of the items of repairs consisted in strengthening both the steering transmission and the rudder stop.

M. S. Williams.

THE RESULT OF A PECULIAR ACCIDENT: THE DESTROYER LAWRENCE IN DRYDOCK.

Unique French Cruising Motor Boats.

Several interesting types of cruising motor boats have been constructed by the Société Delahaye, of Paris, France, including the *Yvonne*, the *Vitu* and the *Vas-y*. The motor boat *Yvonne* is equipped with a 16-horsepower Delahaye engine of the four-cylinder vertical type, operating at a normal speed of 1,250 revolutions per minute. The engine is 1.15 meters (45½ inches) in length, and occupies a floor space 500 millimeters (20 inches) in width. This cruiser, operating with alcohol as a fuel, won the second prize at the Chameinnat de la Mer races.

THE FRENCH MOTOR CRUISER VAS-Y RUNNING AT LOW SPEED.

The cruisers *Vitu* and *Vas-y* are equipped with 50-horsepower Delahaye engines of the four-cylinder type, which operate at a normal speed of 1,150 revolutions per minute. These motors are 1.5 meters (59 inches) in length, with a width of 500 millimeters. The *Vas-y* won the first prize at the regattas de Poissy-Meulan, also at the Maison-Laffitte regatta. The boat is 10.5 meters (34 feet 5 inches) in length, and was entered in the class of cruisers from 8 to 12 meters (26¼ to 39⅜ feet), the course being 100 kilometers (62 statute miles) in length.

THE 16-HORSEPOWER MOTOR CRUISER YVONNE.

Repairs to the Hulls of Steel Ships.

At the Institute of Marine Engineers, Oct. 28, a paper was read by Robert Elliott, B. Sc., of Greenock, of which an abstract follows:

In the case of damaged shell plates, fairing in place can sometimes be done by drilling a hole or holes in the deepest part of the indentation, and using a screwed bolt and a "strong back" to draw it out fair. In the case of plates removed, care must be taken in rolling the plates to fair them, so that they may not be stretched or elongated. The rivet holes in all outside strakes of shell plating should be re-countersunk before riveting, and careful examination made of the plates between the rivet holes, to insure that the plates have not been fractured in driving out the rivets.

Frames at the fore and after ends of vessels, on account of their shape, are difficult to renew for the whole of their length, and a satisfactory repair can be effected by cutting the damaged parts of the frame out and fitting new length for the parts cut out; care being taken that where a number of damaged frames are together, the butts of two adjacent frames should be kept well apart, in a vertical direction. Reverse frames, stringer, keelson and other angle bars may be treated in a similar manner; while stringer plates, deck plating, tank top plates, bulwark plating and bulkhead plates are dealt with similarly to shell plates.

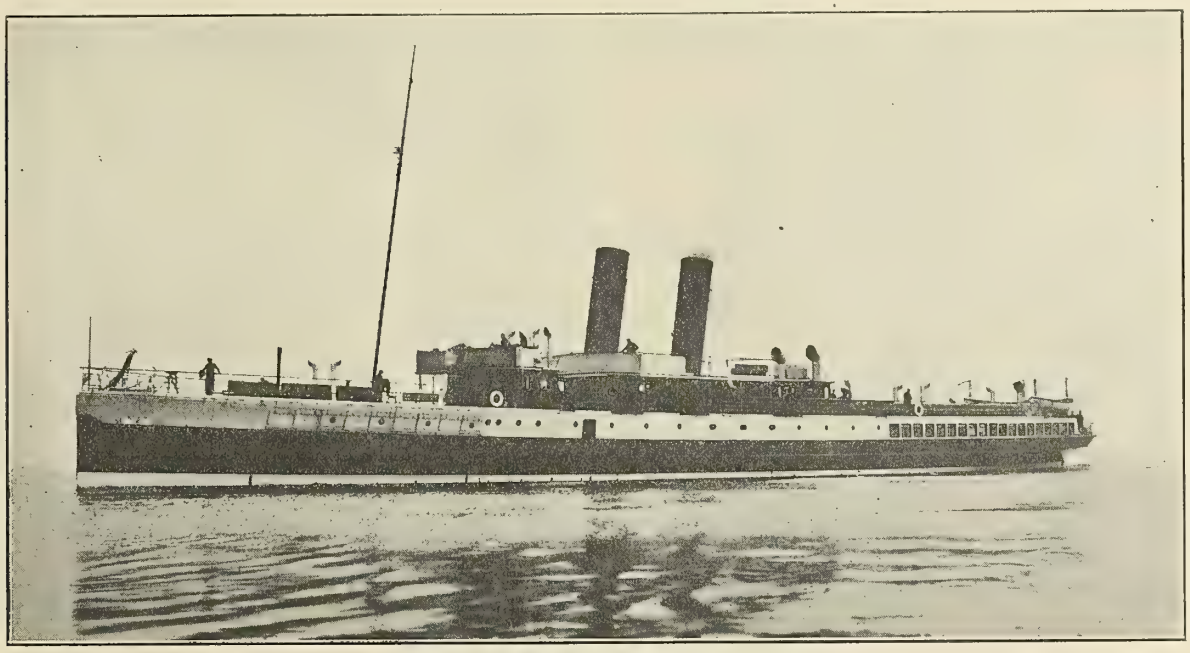
In dealing with repairs due to wear and tear, more liberty can be taken in fitting parts of frames or reverse frames, etc., also in fitting doubling plates over parts wasted, as most owners do not object to these in an old vessel, whereas in repairs due to damage, most of the parts damaged require to be renewed, or made equal to what the parts were originally.

In the case of ballast tanks under boilers, the various methods adopted to prevent corrosion include a covering of Portland cement spread over the tank top to a depth of about 2 inches, a layer of brickwork, Bitumastic cement applied hot to the tank top, or covering the bottom of the boilers with asbestos blankets. In all these methods the efficiency depends on the height of the bottoms of the boilers from the tank top. In the inside of the tank the usual method is to cover the floor with cement wash. Other methods adopted are—coating with boiled oil, and the application of a mixture of white lead and tallow.

In the discussion which followed, the too frequent use of doubling plates in making repairs was deprecated and the necessity of careful application emphasized wherever cement or paint is used. For the ballast tanks, the use of boiled oil was considered a good method of preventing corrosion, while a mixture of white lead, tallow and a little engine oil as a preservative was recommended.

It was shown to be common practice in cases of damage to the ends of the longitudinal girders in ballast tanks to fit bracket plates at every third floor, on alternate sides of the girder, attaching the longitudinal girders to the reverse frames of the floor, in order to compensate for the loss of longitudinal strength. In the construction of ballast tanks, the necessity was mentioned of a flexible tube for connecting the ends of the cast iron pipe to the bulkhead.

Experience does not seem to justify recommending at present electric or oxy-acetylene welding for such large surfaces as stern frames, although it acts very well with boiler plates. It was observed that the cement in bilges was in most cases not high enough, and the floor suffered in consequence. A better system of ventilation was advocated to prevent corrosion in the ballast tanks under the boilers, with four 8-inch pipes arranged so as to form cross currents of air at the bottom of the tank. The use of asbestos blanketing was deprécated on account of its preventing leaky rivets or seams from being detected.



THE NEW TURBINE STEAMER DUCHESS OF ARGYLL.

Clyde Turbine Steamer Duchess of Argyll.

The facilities afforded by the passenger steamers on the Firth of Clyde have been responsible for the development of the coast towns and pleasure resorts, and many of the popular watering places have been brought into existence by the plying of these steamers. The Clyde passenger traffic is practically controlled by the three railway companies, Caledonian, Glasgow & South Western, and North British Railway. The latest addition to the fleet is the new turbine steamer *Duchess of Argyll,* which was built by Denny & Brothers, Dumbarton, for the Caledonian Steam Packet Company's service on the Clyde between Ardrossan and Arran. So far as general dimensions are concerned, she resembles the *King Edward,* with which Messrs. Denny introduced the turbine system of propulsion to merchant vessels in 1901. The new steamer is the sixteenth "turbiner" to be launched from their yard, and she embodies all the improvements obtained by the experience of the past six years. She is built on very fine lines, and her appearance on the water gives the impression of grace and power.

Her principal dimensions are as follows:

Length between perpendiculars	250 feet
Breadth molded	30 feet
Depth	10 feet 6 inches
Draft	6 feet
Displacement	700 tons
Block coefficient	0.544
Indicated horsepower	3,750
Speed	21 knots
Admiralty coefficient	195

She is built of mild steel, in accordance with Board of Trade requirements.

The propelling machinery consists of three Parsons turbines, one high-pressure driving the center shaft, and two low-pressure driving the side shafts. On the exhaust end of each low-pressure turbine is placed a reversing turbine. On each propeller shaft there is one propeller of 52 inches diameter. The two boilers are constructed entirely of steel, and adapted for a working pressure of 150 pounds per square inch.

On trial trip the average coal consumption was 1.8 pounds per hour per equivalent indicated horsepower, and she maintained a speed of 21.65 knots on the run between the Cloch and Cumbrae lighthouses, the mean speed of the double run being 21.1 knots.

The ship has four decks—lower, main, promenade and shade. The promenade deck extends from stem to near the stern, and is the full width of the vessel. Above the promenade deck is the shade deck, which forms a convenient landing place at low tide. The main deck extends the full length of the ship, a short portion at fore end being open above the bulwark to facilitate the handling of ropes and moorings. This open space is inclosed with portable storm boards during rough weather. On the main deck forward is the second class saloon, which, together with the alleyways at the sides of boiler and turbine spaces, forms a shelter in wet weather. Aft of the turbine room and on the main deck is the first class saloon, which is framed in padouk, a Burmese timber of rich color. The windows are large, so as to give a clear outlook.

Steam steering gear is provided for working the stern rudder, which is of the balanced type. A bow rudder is also fitted, to enable the ship to be accurately steered when backing out of harbor. The vessel is fitted throughout with electric light, including mast head and side lights. An interesting feature is the arrangement for stowing the 2,000 life belts, most of them being stowed on the underside of promenade deck in hinged racks, so arranged that in a few seconds they can be made available for use. ALLAN MCPHERSON.

INTERNATIONAL MARINE ENGINEERING

Published Monthly at

Christopher St., Finsbury Square, London, E. C.

E. J. P. BENN, Director and Publisher

and at

17 Battery Place New York

By MARINE ENGINEERING, INCORPORATED

H. L. ALDRICH, President and Treasurer

GEORGE SLATE, Vice-President

E. L. SUMNER, Secretary

SIDNEY GRAVES KOON, Editor

Branch Offices { Philadelphia, Machinery Dept., The Bourse, S. W. Anness.
Boston, 170 Summer St., S. I. Carpenter.
Chicago, 625 Monadnock Block, Howard S. Moss.

Entered at New York Post Office as second-class matter.
Copyright, 1907, by Marine Engineering, Inc., New York.
International Marine Engineering is registered in the United States Patent Office.
Copyright in Great Britain, entered at Stationers' Hall, London.

The edition of this issue comprises 6,000 copies. We have no free list and accept no return copies.

Notice to Advertisers.

Changes to be made in copy, or in orders for advertising, must be in our hands not later than the 5th of the month, to insure the carrying out of such instructions in the issue of the month following. If proof is to be submitted, copy must be in our hands not later than the 1st of the month.

Engineering Misinformation.

In another column will be found a quotation from one of our contemporaries, in which an authority upon the subject of coal mining has entered into a discussion on the subject of coal consumption of steamships, this being, of course, very intimately related with the subject of marine propulsion. Unfortunately, this gentleman used totally erroneous assumptions in his computations, and an article which should have had an educational value has appeared, in which the misleading factor is very large indeed. Not only were the assumptions incorrect, but the results obtained from the computations were equally wrong. We have set the matter right in this issue, so far as it was possible with the meager information at hand, and have given not only the correct method of figuring in a case of this sort, but also results which, under the set of circumstances which we have assumed, would be liable to be achieved.

It is a well recognized fact among marine interests generally that there is nothing much more elusive than the subject of propulsion treated without a full knowledge of all the facts in the case. The length of the ship has a large effect upon the speed, because upon this length and upon the length of the wave set up by the bow depends in large measure what is known as the wave-making resistance. This wave length is a pretty definite function of the speed of the ship, because the length of the bow wave from crest to crest will vary about as the square root of the speed. The relation between the length of the wave and the length of the ship is of importance, by virtue of the position which the second crest of the wave would occupy with regard to the stern of the ship, experiments having shown that for certain positions of this crest a disproportionate increase of power would be required for small increases in speed, while for other positions these small increases could be obtained with comparatively slight addition to the power.

It is largely on account of the peculiarities existing with regard to the relation between power and speed, as exhibited in the last sentence, that it is impossible to state a definite function of the speed according to which the power will vary. For certain speeds the assumption that the power varies as the cube of the speed is entirely correct, and it is nearly correct for all speeds which are not greater than should be expected of the design in question. It will be noted, however, by referring to the bottom of first column, page 458 of our November number, where for two specific cases this index is seen to be 4.58 and 5.98, respectively, that, under certain conditions not easy to predicate in advance, a computation based on the cube of the speed would give results utterly unreliable. It is for this reason that we approach the computation of the coal consumption above mentioned with some little hesitation, because it is perfectly certain that no such computation can be absolutely, or even in general very nearly, correct. However, in the absence of more specific knowledge on the subject, the method we have used is the only one which can well be employed.

Aside entirely from the figures given in this particular case, we are brought face to face with a problem of no little importance in connection with the educational value of technical magazines. The contemporary from which we have quoted is a journal of extremely high standing in its own particular field, and, as such, its value to its readers is very high indeed. The publication, however, of an article of this sort means the spreading broadcast, not only of misinformation, but, we may almost say, of unsound doctrine. The gentleman who wrote the article, while an authority in his own line, is not only not an authority on marine propulsion, but he is absolutely not at all familiar with the subject, and apparently has not at hand the best means of setting himself right. It is for this reason that a subject such as that under discussion should always be left to some one who is an expert along that particular line, in order that the educational value of the article may not be lost, and the standing of the journal

thereby impaired. Nor is this merely a case of loss of educational value—such an article is really a very heavy detriment, because of the misstatements which it contains. It not only does not add value, but it takes away very largely from the value of the magazine as a whole.

We have spoken thus freely on the subject in an entirely friendly spirit, and because we realize how extremely important it is that a magazine of the high character of our contemporary should run no risk of jeopardizing its influence in the engineering world. Engineering is not much of a mystery to those initiated, although certain portions of the field are as closed books to those whose activities have been confined exclusively to other portions, widely divergent from them. It is not an exact science, but its qualifications in that regard are such that, in most cases at least, certain definite results may be achieved without too much allowance for unforeseen contingencies—provided always that the designer is one properly qualified to design; in other words, that he is a specialist in the department in which he is working.

The American Battleship Cruise.

Much interest has been manifested all over the world in the approaching cruise to the Pacific through the Straits of Magellan of a large fleet of battleships of the United States Navy. Efforts have not been wanting to give this cruise a deep political significance which it does not deserve. It seems to be the intention of the authorities to make the cruise simply for the purpose of giving practice to the men upon the ships participating, to leave the fleet for some time in the Pacific waters of the United States, and then to complete the circuit of the globe by sending the fleet back to the eastern coast of the United States by way of the Indian ocean, the Suez canal and the Atlantic ocean.

The political significance which it was attempted to attach to this program was based upon certain fancied national differences of opinion between America and Japan, magnified by the daily press so as to afford news items of a highly colored character. There have been serious differences of opinion, and these still exist. They are of a character, however, very similar to certain differences existing between Japan and her defensive ally, Great Britain, and, while their importance at the local points affected has been considerable and may yet cause a certain amount of friction, yet their scope is by no means such as to give cause for worry to the supporters of a universal peace among nations.

The fleet which has been designated to make the cruise is the very flower of the American Navy. It consists of sixteen first-class battleships in four divisions of four ships each; this squadron has been preceded by two splendid armored cruisers, and is to be followed by a flotilla of half a dozen torpedo-boat destroyers.

The battleships represent five types, ranging from 11,520 to 16,000 tons in displacement, and from 16.82 to 19.26 knots in speed. The aggregate displacement is 223,436 tons, or an average of 13,965 tons, while the mean speed is 18.28 knots. The aggregate main batteries include sixteen 13-inch, forty-eight 12-inch, eighty 8-inch, sixty 7-inch, one hundred twenty-four 6-inch, and twenty-eight 5-inch guns, with a total broadside fire of 81,390 pounds (36.3 tons) of metal at one discharge. Five of the ships, of the *Connecticut* class, are among the most powerful afloat, having each a broadside of four 12-inch, four 8-inch and six 7-inch guns.

Needless to say, this wholesale transfer of the naval striking arm from the Atlantic to the Pacific will leave the Atlantic coast of the United States almost clear of naval defense. At an earlier stage of the world's civilization (always presuming equal facilities for communication) this state of affairs would have placed the great republic invitingly open to attack. Under present conditions, however, the demands of commerce for uninterrupted prosecution of trade would place such an attack far out of reach of any "jingoistic" element which might seek to initiate it.

American Society of Mechanical Engineers.

The fifty-fourth annual meeting of this society will be held in the Engineering Societies building, New York, Dec. 3 to 6, 1907. Symposiums on foundry practice, giving the experience of prominent men in that work, have been arranged. The specific heat of superheated steam will be taken up, as well as the utilization of low-grade fuels in gas producers, tests of producer gas engines, combustion control in gas engines and other live topics, such as industrial education, power transmission by friction driving, and cylinder port velocities. All these subjects have been treated by prominent engineers of Europe and America, professors in our engineering universities, and men eminent in the particular work of which they write.

While the deliberations of this society rarely touch the marine field directly, yet the whole subject matter of engineering is so interwoven, one part with another, that what interests one society cannot be said to be entirely devoid of interest to other branches. The particular items in the coming meeting of the Society of Mechanical Engineers which are of more than passing interest to those engaged in marine work are those calling attention to the utilization of low-grade fuels in gas producers, tests of producer gas engines, and combustion control in gas engines. The subject of cylinder port velocities, while one of live interest to the marine engineer, is taken up here entirely from the standpoint of stationary practice, and would be applicable to our special case only in general measure.

Progress of Naval Vessels.

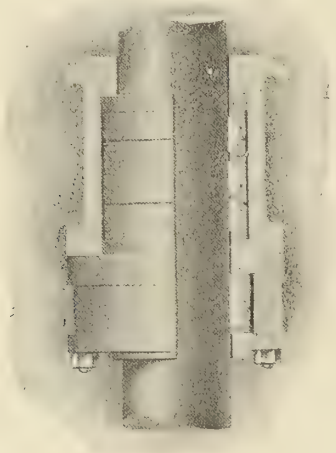
The Bureau of Construction and Repair, Navy Department, reports, October 10, 1907, the following percentage of completion of vessels building for the United States Navy:

	Tons.	Knots.		Sept. 1	Oct. 1
BATTLESHIPS.					
Mississippi	13,000	17	Wm. Cramp & Sons	91.97	94.96
Idaho	13,000	17	Wm. Cramp & Sons	86.01	87.54
New Hampshire	16,000	18	New York Shipbuilding Co.	83.	85.3
South Carolina	16,000	18½	Wm. Cramp & Sons	21.7	24.66
Michigan	16,000	18½	New York Shipbuilding Co.	24.	25.7
Delaware	20,000	21	Newport News S.B. & D.D.Co	0.0	0.65
ARMORED CRUISERS.					
South Dakota	13,680	22	Union Iron Works	98.9	99.9
North Carolina	14,500	22	Newport News Co	88.99	91.5
Montana	14,500	22	Newport News Co	82.58	84.62
SCOUT CRUISERS.					
Chester	3,750	24	Bath Iron Works	88.72	90.64
Birmingham	3,750	24	Fore River Shipbuilding Co.	87.75	89.46
Salem	3,750	24	Fore River Shipbuilding Co.	86.57	86.99
SUBMARINE TORPEDO BOATS.					
Cuttlefish	—	—	Fore River Shipbuilding Co.	99.	99.
Viper	—	—	Fore River Shipbuilding Co.	99.	99.
Tarantula	—	—	Fore River Shipbuilding Co.	99.	99.
Octopus	—	—	Fore River Shipbuilding Co.	99.	99.

ENGINEERING SPECIALTIES.

Combination Metallic Packing.

The piston rod packing illustrated is placed on the market by the Combination Metallic Packing Company, Limited, of Gateshead-on-Tyne. It will be seen to consist of a series of rings of soft metal, gripping the rod in such a manner that,



with proper length of gland, no steam can escape past it. It is stated that this packing has been fitted to 800 war vessels in 20 navies, and 1,000 passenger and other merchant vessels in 423 steamship lines.

A Welded Exhaust Pipe.

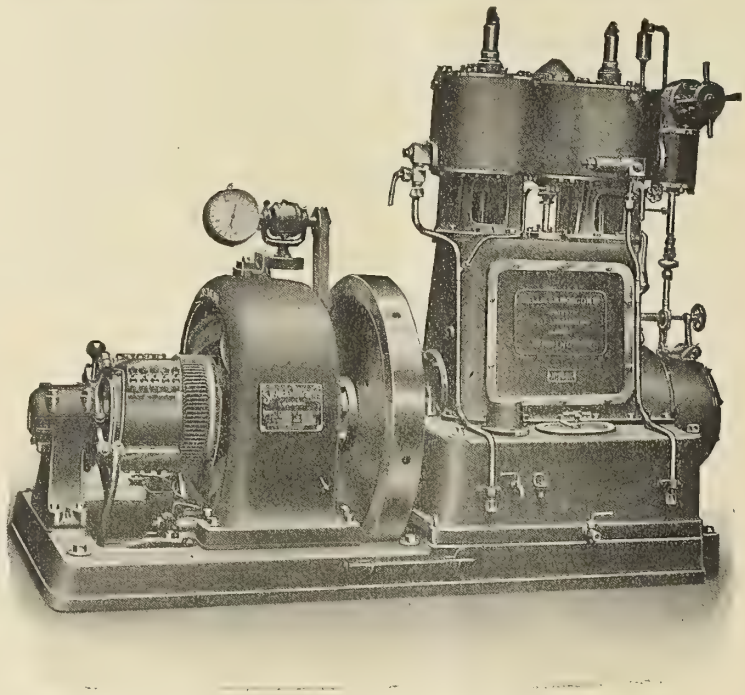
Among the welded specialties of the Steel Barrow Company, Limited, Uxbridge, are a number of devices for use with motor boat engines, among which may be mentioned water-jacketed exhaust pipes, stern tubes, gasoline tanks, mufflers (silencers) and expansion pipes.

The exhaust pipe which we illustrate was made up of sheet steel 1/16 inch thick, for use on a six-cylinder engine. It consists of a double tube with flanged branches welded in and flanged ends, together with projecting inlet and outlet pipes, also welded in, for the circulation of water. The weight of this tube, which is about four feet long, is only 28 pounds, whereas the brazed copper tube which it replaced weighed 112 pounds. It is stated that this saving of weight is combined with an increase in durability, which would appear to make the article of much importance, particularly in high-speed boats.

A Ship Lighting Set.

The installation illustrated was supplied by Belliss & Morcom, Limited, Birmingham, to the Peninsular and Oriental steamship *Mooltan*. The set consists of a self-lubricating, high-speed, double-acting engine of the two-crank compound type, direct connected to a generator of 40 kilowatts, built by Siemens Brothers Company, of London.

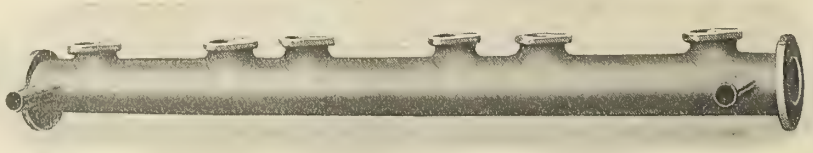
The engine is rated at 58 brake horsepower when operating at a speed of 450 revolutions per minute. Five of these sets



are fitted in the steamer, supplying current for 1,400 incandescent lamps of 16 candlepower; 400 12-inch electric fans; six forced-draft fans; four large ventilating fans; a searchlight of 8,000 candlepower; six coaling lamps of 20,000 candlepower each; electric headlight and side lights, and two Brockie-Pell lamps of 40,000 candlepower each.

Marine Annunciators.

A new type of annunciator designed for marine use by the Holtzer-Cabot Electric Company, Brookline, Mass., although not claimed to be watertight, yet has the mechanism so thoroughly protected that it will withstand the dampness and moisture on shipboard without in any way corroding the metal parts or affecting the operation. Standard gravity drops are used, but the coils are thoroughly treated with a moisture-proof compound, and baked so as to prevent any short



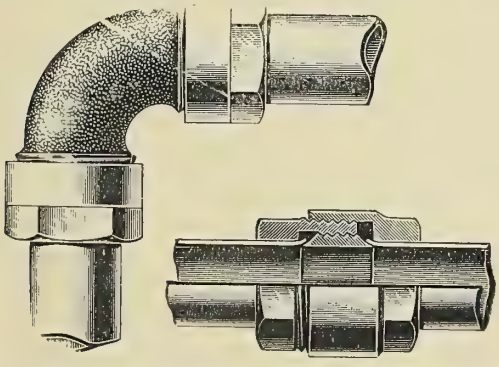
circuiting caused by the disintegration of the insulation from dampness. Non-corrosive metals are used, so as to prevent all possibility of rust forming at the pivot points and interfering with the instantaneous operation of the drop. The drops are reset by means of a checking rod, which passes through a rawhide gasket secured to the inside of the frame.

The case is of heavy wood construction, with round corners, and is usually finished to match its surroundings. It is made in two sections, the backboard and the cover. All the con-

nections are brought to the backboard, on which the drops are mounted, so that this portion of the annunciator may be installed and tested without closing the cover, and the perfect working of the instrument be insured. The holes in the backboard, through which the wires pass, are filled with a moisture-proof compound, rendering this part of the annunciator practically watertight. The cover is hinged to the backboard and is fitted with a tubular rubber gasket, so that when closed it makes a perfect fit, and prevents the ingress of all moisture. As a further precaution against dampness, paraffin wax is run around the edge of the glass, where it meets the frame.

Wedgring Joints.

These joints, which are placed upon the market by Benjamin Parker, Ltd., Birmingham and London, are designed for coupling copper, brass and other tubes in such a manner as to do away with any necessity for screwing the tubes. The object of this is to make possible the use of tubes of a lower gage than would be necessary for screwing. The joint consists of two cylindrical shells, and the wedgring, which also is cylindrical. The inner shell has screw threads cut on the

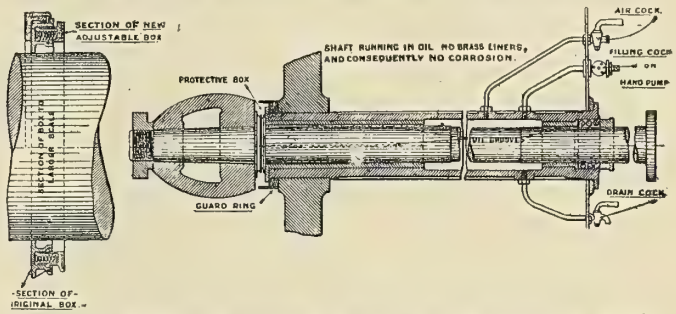


inside to receive the wedgring, and others on the outside to take the outer shell. Both inner and outer shells are recessed to receive the flared ends of the tube, thus forming a shelter by which, under the influence of the wedgring, the joint is made.

This joint is extremely neat in appearance, and can easily be disconnected for cleaning purposes. The ends of the tube are flared out a very slight amount by a special tool, the wedgring is screwed home by means of another tool, and the joint is made in less than 5 minutes. It is said that the area of the tube is not in the least diminished by the wedgring, and that the joint when made will stand hydraulic pressure up to 1,000 pounds per square inch. Being a metal-to-metal joint, no red lead or other joining material is required.

A Propeller Shaft Lubricating Box.

The illustration shows an arrangement of a protective lubricating box with oil grooves, cocks and pipes, as placed upon the market by F. R. Cedervall & Soener, of Gothenburg, Sweden. It is claimed for this device that it increases the number of revolutions of the engines, enables the tail shaft to be efficiently lubricated by oil, prevents sea water and grit from entering the stern tube, dispenses with all need for costly brass liners on the shaft and for lignum vitæ bearings,



practically eliminates galvanic action, and furnishes a maximum safety against breakdown of the shaft.

The present device has three or more grooves, all in the stern tube bushing, the top one being for the escape of air, while the others are for leading the oil to the inside of the movable ring of the protective box. From the stern tube three pipes are carried through the after bilge, and fitted with cocks. Oil is forced in by means of a small hand pump through one cock, while the other two are for overflow and drainage.

TECHNICAL PUBLICATIONS.

Steamship Coefficients, Speeds and Powers. By Charles F. A. Fyfe. Size, 4 by 6½ inches. Pages, 280 + 31 plates. London, 1907. E. & F. N. Spon, Ltd. Price, in flexible covers, 10/6 net. New York: Spon & Chamberlain. Price, $4.

This is a pocketbook containing the dimensions and performances of nearly a thousand vessels of diverse type, form and characteristics, each being reduced to a standard of 100 feet in length. There are also progressive trials, eighty in number, of ships and models, with notes on Froude's Law of Comparison, skin friction corrections, engine efficiency, propellers, the Admiralty formula, angles of entrance, fineness appropriate to various speeds, etc. The data has been taken particularly from papers by eminent naval architects who have contributed towards the improvement of sound methods of comparing steamship performances. The importance of considering the ratio of beam to length in all questions of fineness appropriate to speed has been emphasized throughout.

The introduction deals with the Law of Comparison, after which are taken up the various subjects mentioned above, while the greater part of the book is devoted to tables and an analysis of them. Included in the list of tables are a number of arithmetical tables, including those showing the two-thirds power of displacements, and the 1.94, 2.94, 1.83 and 2.83 powers of various numbers which may be taken to represent speeds. The large amount of data collected, and its great diversity with regard to the character of vessels, renders the work an exceedingly valuable one for reference and for consultation, when it comes to a question of design.

Electrical Installations of the United States Navy. By Commander B. T. Walling, U. S. N., and Julius Martin, E. E. Size, 5⅝ by 9¼ inches. Pages, 648. Figures, 301. Annapolis, Md., 1907. The United States Naval Institute. Price, $6 net (24s.).

This is a manual of the latest approved material, including its use, operation, inspection, care and management and the method of installation on board ship. The work is divided into fifteen chapters, of which the first two deal with incandescent and arc lamps and searchlights; the next two with wire and wiring appliances; the next two with generating sets; the seventh, eighth and ninth, with motors and their application; the next, with the inspection of generators and motors; the eleventh and twelfth, with apparatus and instruments used in connection with generators and motors, and with their tests, as well as general notes on these pieces of apparatus, while the last three chapters cover electric fixtures and lanterns, communication, and notes on installation.

The work is gotten up in a very thorough manner, and includes descriptions of apparatus from a wide variety of designers, because of the fact that the navy has been supplied with apparatus from many builders. Both half tones and line cuts are used, according to necessity, and the number of illustrations is evidence of the completeness with which this part of the work has been carried out. Details of the engines for lighting and power purposes are given, even to such small matters as metallic packing, rocker arms for yalve mechanism, and grease cups. The electric connections are shown in the usual diagrammatic form, with enough in the way of illustration to furnish a complete description. Many of the cuts are of the clear, sharp, wax type, though a few are rather crude zinc cuts.

The chapter on communication deals with material used for simple methods of calling attention to the point of origin of the call, by bell, buzzer or annunciator. This includes various kinds of indicators, and engine and steering telegraphs, fire alarms and stoking signals. It includes also semaphores, but does not touch the subjects of wireless telegraphy or submarine signaling. One defect of the volume is in the lack of a comprehensive index.

Saint Mary's Falls Canal. Semi-Centennial, 1905. Compiled and edited by Charles Moore. Size, 7¾ by 10½ inches. Pages, 286 + xx. Illustrations, 83. Detroit, 1907: The Semi-Centennial Commission. Not for sale. Supplied to libraries at cost of shipment, 30 cents.

This work is commemorative of the semi-centennial of the canal, and of the exercises at the celebration at Sault Sainte Marie, Mich., Aug. 2 and 3, 1905. It contains also an elaborate history of the canal, by John H. Goff, and papers relating to the Great Lakes, to the traffic upon the Lakes, and to the traffic through the canal. It is splendidly printed and illustrated, the views covering buildings and scenes along the line of the canal, taken from photographs and from old prints, as well as ships which have reached prominence in the traffic of the canal, and men whose work is represented there. A chart showing the American and Canadian canals with their locks, as well as the power canals and the approaches from each direction, is given in colors, while the frontispiece, illustrating the squadron representing the naval parade leaving the Poe Lock on Aug. 2, 1905, is a splendid half-tone made by the three-color process.

The book contains a number of special articles, including the Celebration, by J. P. Nimmo; the Governor's Address, by Hon. Fred M. Warner, Governor of Michigan; Historical Address, by Hon. Peter White; Address, by Hon. Charles W. Fairbanks, Vice-President of the United States; Greeting of the Dominion of Canada, by Hon. Rodolphe Lemieux, Solicitor General; the Improvement of Lake Channels, by Hon. Theodore E. Burton; the Commerce of the Great Lakes, by Hon William Livingstone; the Future of American Commerce, by Hon. Julius C. Burrows; Canada and the United States, by Hon. Raoul Dandurand, speaker of the Senate of the Dominion of Canada; Incidents of the Celebration; Commerce of the Great Lakes in 1905, by Ralph D. Williams; Pleasure Boating on the Great Lakes in 1905, by Robert E. Power; and a list of vessels navigating the Great Lakes in 1905, arranged alphabetically according to the name of the owning company or interest. At the end is a chronological record of the principal contracts connected with the improvement of the river and canal, followed by an index of the entire work, and lists of ships, captains and engineers on the Great Lakes, arranged alphabetically.

Hendricks' Commercial Register of the United States. Size, 7½ by 10 inches. Pages, 1,215. Samuel E. Hendricks Company, 74 Lafayette street, New York. Price, $10.

This is the sixteenth edition of a book which has appeared annually since 1891. It comprises a complete list of all concerns in the United States available for the use of both buyers and sellers connected with such industries as architecture, mechanical engineering, contracting, electrical engineering, railroad work, iron, steel, mining, milling, quarrying, exporting, etc. The first edition of this register, published in 1891, contained about 500 pages, and required only eight pages to index the material. It was devoted solely to the building industry of the country. From this the publication has grown until the present edition includes over 1,200 pages, containing upwards of 350,000 names and addresses classified under 31,212 trade headings, and requiring 76 pages for the index.

As an illustration of how the system of classification makes the lists available for both buyers and sellers,— in the case of "machinists and founders," all firms operating machine shops and foundries are listed under those heads for mailing purposes. Then each firm is sub-classified under headings that cover every variety of its product. Not only has the present edition been enlarged, but the lists have been carefully revised, corrected and brought up to date.

The Blacksmith's Guide. By J. F. Sallows. Size, 4½ by 7 inches. Pages, 157. Illustrations, 165. 1907, Brattleboro, Vt.: The Technical Press. Price, bound in cloth, $1.50; bound in leather, with round corners, $2.00.

This little work, which is of convenient size to fit into the pocket, has been prepared by a blacksmith of years of experience, whose specialty has been along the line of hardening and tempering of tools. The work contains valuable instruction on forging, welding, hardening, tempering, treatment of high speed steel, case hardening, annealing, coloring, brazing and general blacksmithing. The methods described in its pages have been developed and tried out by the author during many years of practical work, and deserve consideration from all firms doing machine work, and all skilled mechanics along this particular line. The processes used by the author in hardening the tools for machine shop work are unique, and are said to have been remarkably successful in competition with similar tools treated by methods commonly known and generally followed

Three of the plates are colored, showing varying degrees of heat and temper, as well as the effects obtained by methods of case hardening and coloring. The other illustrations are largely line drawings, showing how various operations are performed, and illustrating the tools used and the products obtained by the various processes described.

With a depth at low water of 35 feet, the new Ambrose channel out of New York harbor has been opened. The final depth is to be 40 feet, and the further work is being carried on. The present depth, however, is such that the largest ocean liners may use the channel at nearly all stages of the tide.

SELECTED MARINE PATENTS.

The publication in this column of a patent specification does not necessarily imply editorial commendation.

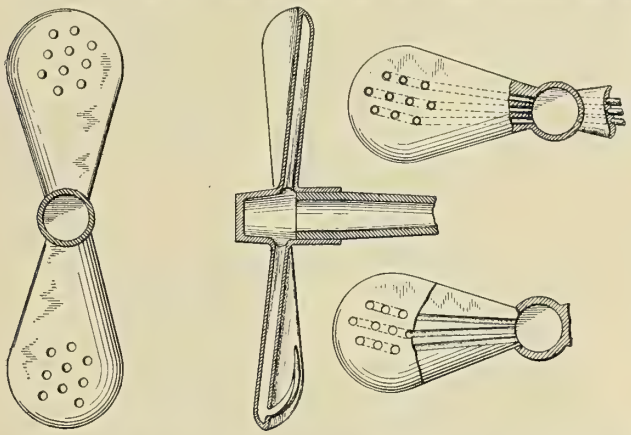
American patents compiled by Delbert H. Decker, Esq., registered patent attorney, Loan & Trust Building, Washington, D. C.

864,190. PROPELLER. JAMES H. PIERCE, BAY CITY, MICH., ASSIGNOR TO SMALLEY MOTOR COMPANY, LIMITED, BAY CITY.

Claim.—1. In a propeller, the combination with a shaft, of an approximately cylindrical hub secured to the extreme rear end of the shaft and extending rearwardly of the shaft, the hub provided with diametrically extending apertures, one located in advance of the other and passing centrally of the hub, shanks oscillatory within the apertures, blades carried by the shanks, the hub provided with offset grooves of different lengths, arms of unequal lengths slidingly received in the respective grooves, a collar slidingly mounted on the shaft, the collar normally lying against the forward end of the hub, the arms connected to the collar pins carried by the arms, and laterally projecting feet located at the juncture of the shanks and blades, the outer ends of the feet being slotted to receive the pins on the arms, the reciprocation of the arms operating to reverse the propeller. Five claims.

864,484. SCREW PROPELLER. FREDERICK W. ORDING, JERSEY CITY, N. J., ASSIGNOR OF ONE-HALF TO EMIL HIGGINS, NEW YORK.

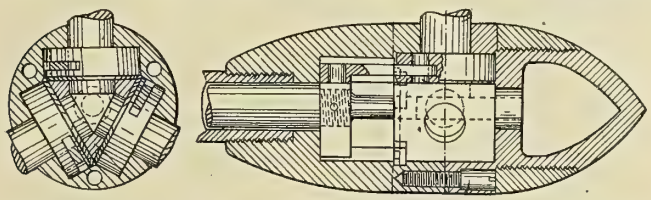
Claim.—1. A screw propeller blade having a fluid passage therein,



provided with an outlet in one face thereof and a lip on the face of the blade adjacent to the outlet. Five claims.

864,875. REVERSIBLE PROPELLER. GEORGE F. VILLINGER, LONDON.

Claim.—1. In a reversible propeller, the combination with the propeller shaft of a propeller boss made in parts, blades carried by said boss and capable of angular adjustment thereon, enlargements on said blades bearing against the interior of the boss, slots in the enlargements, eccentric pins passing through said slots, a separate stationary



block having a projection at one end entering the boss, said block being fixed in said boss, rotating therewith and acting as a bearing for the inner ends of the blades, a reversing rod, a block fixed on the reversing rod and movable in the boss, pins on said movable block, links on said pins, the other ends of said links entering said slots and being connected to the eccentric pins carried by the enlargement. Three claims.

864,942. PROPELLER GEAR. WILLIAM WITT, PORT CLINTON, OHIO.

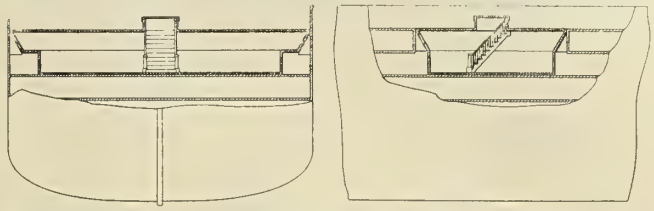
Claim.—1. In a device of the described character, an engine, a stub shaft for the engine, a gear wheel on the shaft, a propeller shaft, a pinion on the propeller shaft engaged with the gear wheel, a bracket upon the base of the engine, a bearing for the propeller shaft on said bracket, a thrust bearing upon the body of the engine for the forward end of the propeller shaft, said pinion being secured to the propeller shaft between said two bearings. Three claims.

865,130. APPARATUS FOR RAISING SUNKEN VESSELS. FERNANDO STAUD Y XIMENEZ, CHICAGO.

Claim.—1. A submergible pontoon for the purpose set forth, comprising a shell equipped with an air pressure and water inlet valve and a water outlet valve, said valves being connected together to adapt them to work simultaneously, and a guide tube through the shell for a lifting cable to direct the shell, by filling it with water for sinking it, toward the point of attachment of said cable to a sunken vessel to be raised. Six claims.

865,155. MARINE VESSEL. THOMAS S. BARWIS, VANCOUVER, B. C., ASSIGNOR OF ONE-HALF TO FREDERICK C. WADE, VANCOUVER.

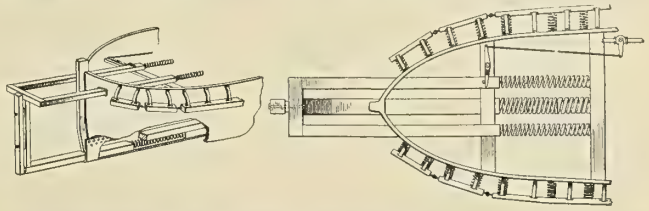
Claim.—1. A marine vessel provided with a deck, a floatable cabin resting on the deck, said cabin having sides and ends inclined downwardly and inwardly for a distance, the sides of the floatable cabin being built inwardly below the inclined portion to form passageways between



the cabin and the sides of the vessel, and gussets on the vessel, which are adapted to fit the tumbled-in sides and ends of the floatable cabin. Four claims.

865,244. PROTECTOR FOR VESSELS IN CASE OF COLLISION. NIELS C. YORGENSEN-GUNDHOLM, BRADFORDVILLE, FLA.

Claim.—1. The combination with a vessel of a casing carried by the keel of the vessel, having a buffer beam working in the casing and projecting in advance of the bow of the vessel, and a plurality of spiral



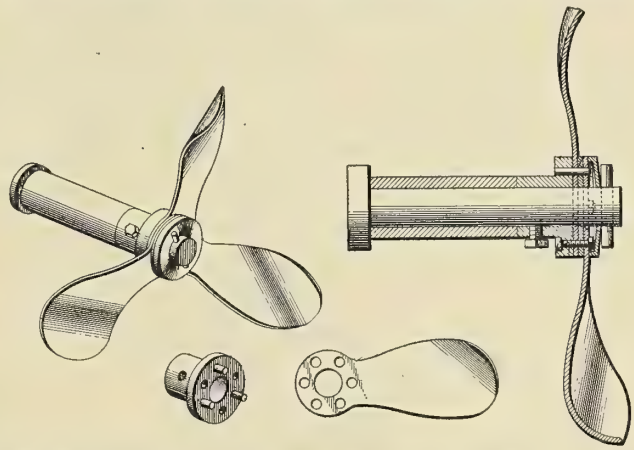
springs arranged in said casing in the rear of the inner end of the buffer beam, said springs increasing in size and strength as the rear end of the casing is approached. Four claims.

866,348. MEANS FOR RAISING SUNKEN VESSELS. GEORGE FEARON AND C. S. FEARON, NEWCASTLE-UPON-TYNE.

Claim.—1. Means for raising a sunken ship or vessel, which consists in a network of fore-and-aft cables adapted to be arranged longitudinally of the hull, and transverse cables placed transversely of and beneath the hull, said fore-and-aft and transverse cables being connected by rings and shackles; air vessels adapted to be secured to the network of cables, and provided at the bottom thereof with rings and shackles whereby they may be connected with the fore-and-aft cables; and bow or stem clamps adapted to engage the bow of the vessel and with which the fore-and-aft cables are adapted to be connected. Three claims.

866,365. PROPELLER. GEORGE W. JACKSON, PHILADELPHIA, PA.

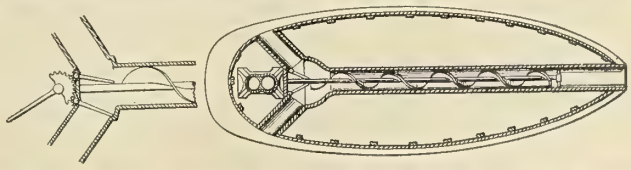
Claim.—1. In a propeller, a blade having a hub portion, a hub member which is separate from said portion, said member and portion having each a central bore to receive a propeller shaft, and a series of open-



ings surrounding said central bore, and separate devices for adjusting and securing the blades on said member, said devices extending parallel through said portion and member. Eight claims.

866,465. PROPELLER AND STEERING DEVICE. WILLIAM J. HEARN, MOUNT VERNON, N. Y.

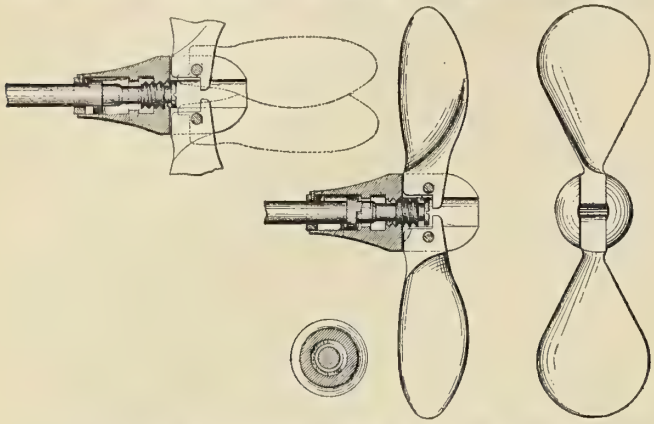
Claim.—A propelling and steering device for vessels comprising a tube extending from the bow of the vessel toward the stern and provided with lateral branches extending out through the sides of the vessel near



the stern, a screw propeller journaled in the tube, means for rotating said propeller, gates hinged at the rear end of the tube at its junction with the branches, a shaft connected to each gate and extending up through the deck of the vessel, pinions on the shafts, and a tiller provided with a toothed sector for engaging said pinions to rotate said shafts. One claim.

866,369. PROPELLER. ARTHUR W. LEARNARD, BOSTON, MASS.

Claim.—1. In a propeller, a propeller shaft; a hub or head on said shaft; means whereby the rotation of the shaft in opposite directions imparts relative longitudinal movement to the shaft; mechanism for imparting rotation to said hub or head in opposite directions at different points in the longitudinal movement of the shaft; blades pivotally secured at their inner ends to the hub or head and adapted by their shape to spread or swing outward and act as propeller blades when the shaft is driven in the ordinary direction, and to fold when the vessel is drawn through the water by sail or other power not connected with the propeller shaft; and means for holding the blades in a spread or expanded position when the shaft is reversed. Three claims.



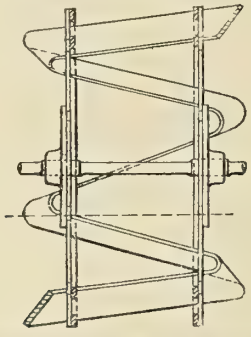
British patents compiled by Edwards & Co., chartered patent agents and engineers, Chancery Lane Station Chambers, London, W. C.

8,538. SHIPS' COURSE RECORDERS. W. C. FORBES AND C. E. CLIFT, SOUTHWARK, LONDON.

The rotor is mounted in a single tube, which passes through a cock capable of closing the aperture in the ship's side when the tube is withdrawn. The rotor is connected to the distance indicator by telescopic rods, so that the tube may be readily withdrawn by means of the rack and pinion. The frame surrounding the compass and carrying the course recording pencil is pivotally mounted on a bridge piece attached to the bowl. A radial slotted arm, engaging with a pin projecting from the frame, is rotated by a light rod mounted on the compass card. The indicator is connected electrically or otherwise with a pencil, which marks the moving indicator sheet. In a modification, the escape orifice for the water leaving the rotor is formed in the part of the tube outside the ship.

8,551. PADDLE WHEELS. COUNT R. KINSKY, KRASNA, AUSTRIA.

In paddle wheels in which plane floats are alternately inclined to the axis, the ends are made conical in form. The floats are made separate



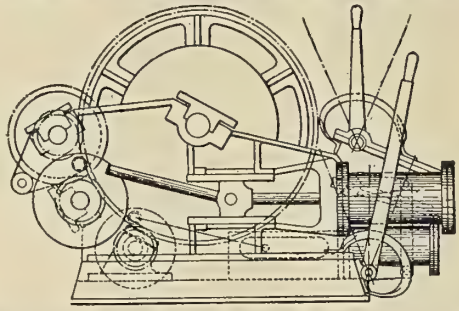
so that single floats may be replaced when damaged. The angles between the floats may also be replaced by plane portions. The invention is differentiated from those employing helicoidal floats with rounded connecting pieces.

9,328. SHIPS' LOGS. E. V. H. RIZZO, LONDON.

In an electric ship log, a shaft connected to the rotor and mounted at the taffrail carries a roller, which, upon lifting another roller carried by a lever, completes an electric circuit through the contact and spring, thus actuating, once for each revolution of the rotor, the counting mechanism, situated at a distance. The shaft is preferably mounted on ball bearings. In the counting mechanism, the armature of an electro magnet rotates, by its connection with the pawl, a ratchet wheel carrying a lever, which rotates the cogged wheel and wheels connected to it through gearing. These wheels carry the indicating hands.

9,278. WINCHES. G. T. MACFARLANE, WOOLAHARA, AUSTRALIA.

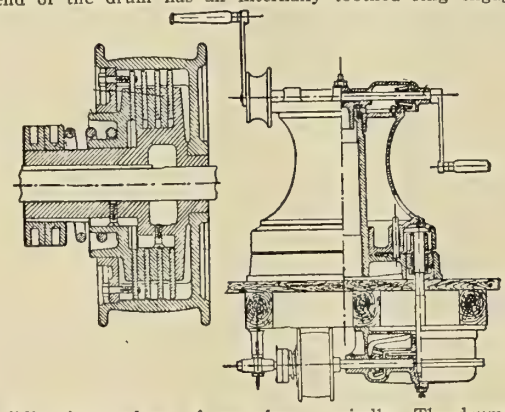
Relates to winches especially suitable for operating ships' derricks. The hoisting and slewing drums are mounted, the latter loosely, on a shaft, and are driven by separate engines. A clutch is provided for utilizing conjointly the power of the two engines upon one or both drums. Any suitable valve gear is provided, and is operated by a single lever, for enabling the engines to be driven in opposite directions and to be brought to rest without the use of brake mechanism. Rotary valves, driven by bevel gear from the crank shafts, and in which the control is effected by sliding the valves longitudinally, are employed.



The valve controlling levers are arranged in juxtaposition, so as to be manipulated by a single operator. The drums may be provided with reversing driving gears, and the various levers operating these may be adjacent thereto, as they do not require to be frequently changed, or they may be arranged adjacent to the other levers. When there are warping ends, the one adjacent to the loose drum may be formed integral therewith.

9,582. CAPSTANS. P. JORGENSEN, COPENHAGEN, DENMARK.

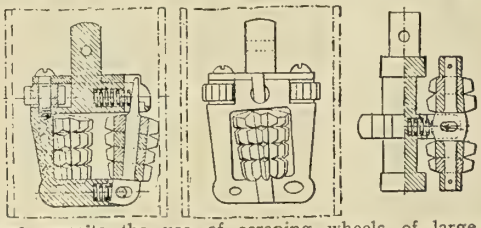
Relates to net hauling capstans for fishing vessels propelled by explosion motors, and consists in an arrangement whereby the barrel may be driven either by hand power or from the propelling motor of the vessel. When the latter driving means are employed, a friction coupling is provided in the transmission gearing to prevent excessive strain from being imparted to the hauling cables. The drum of the capstan is mounted upon a vertical spindle, carrying at its upper end a horizontal spindle actuated by hand cranks and rotating the drum through bevel wheels. This hand gear may be removed by withdrawing the nuts. The lower end of the drum has an internally toothed ring engaged by a



pinion sliding into and out of gear along a spindle. The drum is driven from the propelling motor of the vessel by a belt passing over a pulley, provided on the inside with dogs carrying soft disks. On the spindle is a hub which, by a projection, carries hard disks intermediate between the soft disks. These disks are pressed together by an end piece actuated by a spring, the tension of which is adjusted by nuts in such a manner that the pulley normally carries the spindle with it, and transmits the motion by bevel wheels to the vertical spindle, but revolves more or less without carrying the spindle under a suddenly increased pull.

10,227. CLEANING TUBES. J. GEORGES AND E. A. DORMOY, ALGIERS, ALGERIA.

Relates to boiler tube and like scaling apparatus of the type in which sharp toothed wheels are mounted on studs having bearings in radial slots. The end plates, fitted with recesses to receive springs which act on the studs carrying the tapered scraping wheels, are connected by pillars, while auxiliary scraping wheels are fitted in the plate. This



arrangement permits the use of scraping wheels of large diameter mounted on strong studs, and the framing is prevented from rubbing the inner surface of the tube. The axes of the wheel studs may be inclined to the longitudinal axis of the frame, and this causes the scraping wheels to bury themselves in the scale when the cleaner is rotated. In a modification, a central body is used instead of the framing, and the wheel studs are pressed by springs against the pivots.

10,813. VALVES. W. GRANT, POLLOKSHIELDS, GLASGOW.

Spring loaded safety valves are constructed so as to prevent buckling of the spring, and consequent injury of the valve. The valve is formed with a recess below its seating, and a recess is formed in the spindle above a flange upon which the spring bears. The pressure of the spring is communicated to the valve by means of a rod with rounded ends, which fit in the recesses. The spindle is guided by a cross-bar, and the rod is made square or hexagonal, and may be provided with holes to allow the valve to be turned on its seat.